VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION
WATERSHED MANAGEMENT DIVISION

Passumpsic River Tactical Basin Plan

Bean Brook, Newark

June 2019 | Draft for Public Review

Tactical Basin Plan was prepared in accordance with 10 VSA § 1253(d), the Vermont Water Quality Standards[1], the Federal Clean Water Act and 40 CFR 130.6, and the Vermont Surface Water Management Strategy.

Approved:

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Cover Photo: Bean Brook in Newark photographed by Fritz Gerhardt (used with permission)

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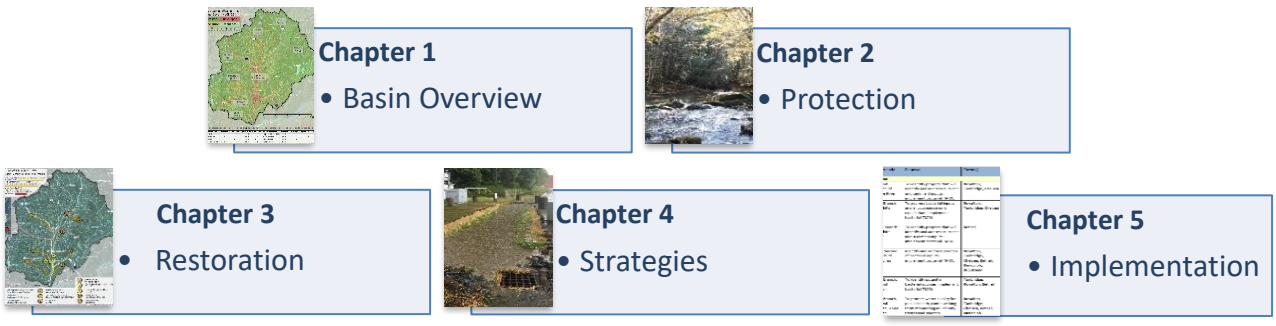
Executive Summary

The Passumpsic Tactical Basin Plan (TBP) provides an assessment of watershed condition and identifies current and future strategies to protect high quality waters and restore impaired water resources based on the approaches set forward in the Vermont Surface Water Management Strategy (VSWMS).

The five chapters in this plan provide a framework for understanding the Passumpsic River Basin (Basin 15), including its unique characteristics and water quality issues, and where and how to carry out priority actions to protect, maintain, enhance, and restore water quality in the basin.



The Passumpsic River Basin drains 507 square miles covering the majority of Caledonia County and minor portions of Essex, Orleans and Washington counties. Many waters in the basin are of high quality and so the basin plan recommends the reclassification of two waters for A(1) for aquatic biota and five for B(1) aquatic biota use and 12 waters for reclassification for B(1) fishing use. Six abandoned drinking water supplies are recommended for reclassification from A(2) to B(1) or B(2) waters. Finally, Victory Basin Wetlands Complex is highlighted as a candidate for reclassification as a Class 1 wetland. On page 14 Figure 9 includes a map of these waters.

There are no impaired lakes or ponds in the basin but eight are identified by the lake score card as having reduced or poor shoreland conditions due to development, three have elevated or increasing levels of nutrients, two are stressed due to acid precipitation, and one pond is stressed for sedimentation as shown on page 8 in Figure 4. The only impaired waters in the Passumpsic River Basin are the Passumpsic and Sleepers River which are listed as due to elevated *E. coli* levels from the St Johnsbury combined waste and stormwater system overflowing. Several other rivers and streams are listed as stressed due to sediment, *E. coli*, nutrients, metals (including nickel) and oil as shown on page 11 in Figure 6.

Chapter 4 of the plan lays out the plan of attack for the next five years to address pollution contributing to these water quality issues (in addition to addressing nitrogen loading to Long Island Sound) and for protecting high quality waters which are all summarized in Table 7 on page 25. Information from assessments in the basin and derived from public input have been pulled together to guide the development of strategies for the agricultural sector, developed lands sector focused on stormwater roads and wastewater treatment facilities, and restoration of forest lands and natural lands along or lakes and streams. A total of 41 strategies are listed in Chapter 5 in the implementation table on page 59 and 73 stream segments or ponds have been identified for additional water quality monitoring in the monitoring priorities table on page 64. Specific implementation projects are listed in the Watershed Projects Database.

What is a Tactical Basin Plan?

Tactical basin planning is carried out for the Vermont Agency of Natural Resources (VANR) by the Watershed Management Division's Monitoring, Assessment, and Planning Program (MAPP) in coordination with watershed partners. Tactical basin plans (TBPs) are developed in accordance with the Vermont Surface Water Management Strategy (VSWMS) and the Vermont Water Quality Standards (VWQS) to protect, maintain, enhance, and restore the biological, chemical, and physical integrity of Vermont's water resources. The basin-specific water quality goals, objectives, strategies, and actions described in the TBPs aim to protect public health and safety, and ensure public use and enjoyment of VT waters and their ecological health.

The TBP process allows for the issuance of plans for Vermont's fifteen basins every five years, as required by statute 10 V.S.A. § 1253. The plans incorporate the U.S Environmental Protection Agency's (EPA) 9-element framework for watershed plans (USEPA, 2008) and meet obligations of the Vermont Clean Water Act. Updating a basin plan includes: 1. Monitoring water quality and summarizing existing information, 2. Assessing and analyzing water quality data, 3. Identifying strategies and projects to protect and restore waters, 4. Seeking public comment and finalizing plan, and 5. Plan implementation and tracking which is ongoing throughout the planning cycle.

Figure 1. Steps in the tactical basin planning process

Tactical basin plans can be considered a strategic guidebook for protecting and restoring VT surface waters for VANR and watershed partners. They identify causes and sources of pollution, opportunities for protecting waters through outstanding resource water designation and reclassification. Plans identify reductions needed to restore water quality including those necessary to meet Total Maximum Daily Load targets, and plans contain implementation tables (Chapter 5) that list strategies to foster education and outreach, and targeted restoration actions that are eligible for federal and State funding. The Plan's strategies, described in Chapter 5's implementation table, target individual projects that are tracked via its online counterpart, the Watershed Projects Database (WPD). The WPD is continuously updated to capture project information from the TBP process, on the ground assessments and emerging projects due to natural and/or anthropogenic events. The 2014 Basin 15 Report Card located in Appendix B provides status and update information on each of the objectives identified in the previous basin plan available here.

Chapter 1 – Basin Description and Conditions

A. Passumpsic River Basin Overview

The Passumpsic River Basin drains 507 square miles, a major portion of Caledonia County and minor portions of Essex, Orleans and Washington counties. The East Branch of the Passumpsic River originates in the town of Brighton and joins the West Branch just northeast of Lyndonville. The Passumpsic River then joins Millers Run which drains the towns of Sheffield and Wheelock and flows over 20 miles to the south until it reaches the Connecticut River in East Barnet passing over a series of seven hydroelectric dams along the way. The basin also includes the Moose River watershed with headwaters in East Haven and includes Victory Bog wetlands complex, along with the Sleepers River and Joes Brooks and several smaller tributaries which are broken out into lower and upper tributaries for this basin plan. A more extensive basin description is available in The Passumpsic Watershed - Water Quality Assessment Report 2018 (VDEC, 2019).

The basin is broken down into 8 subwatersheds that have unique characteristics including different land use patterns as shown in Figure 2. The Moose River and East Branch are the least developed of the major watersheds with only a small percentage of developed or agricultural lands, while the upper and lower tributary watersheds are much more developed with nearly one quarter developed or agricultural land. The remaining watersheds have a similar level of developed lands compared to the basin as a whole, with around six percent developed lands and approximately double that percentage of agricultural lands. These broader land use patterns influence the conditions of waters in these subwatersheds. More waters are identified for protection in the less developed Moose River watershed, although there are localized water quality impacts in this watershed including elevated levels of *E. coli* in the Chesterfield Valley Brook. There are also pockets of higher quality waters in more developed watersheds such as in the Calendar Brook and Stannard Mountain Brooks which are recommended for a higher level of protection in this plan.

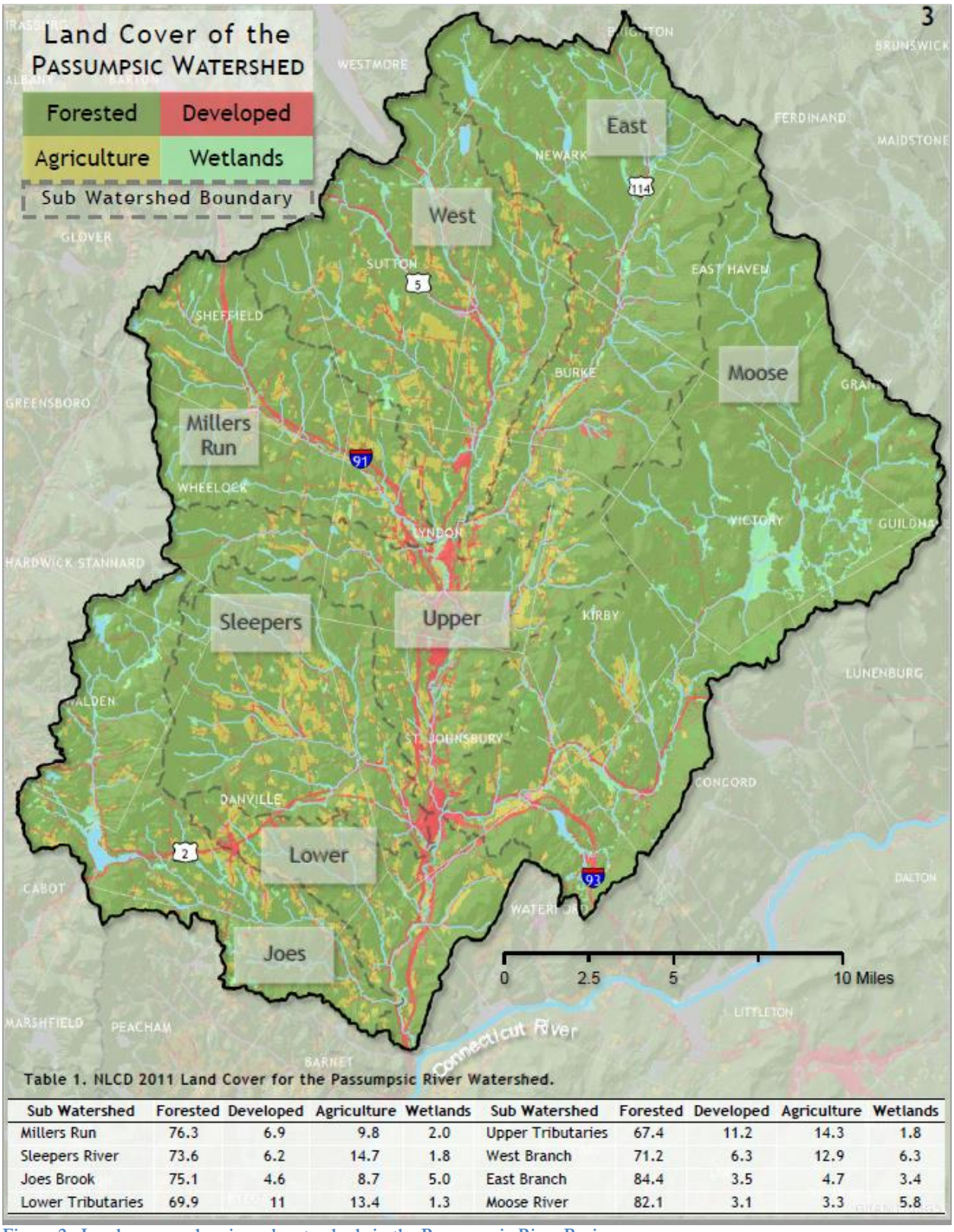


Table 1. NLCD 2011 Land Cover for the Passumpsic River Watershed.

Sub Watershed	Forested	Developed	Agriculture	Wetlands	Sub Watershed	Forested	Developed	Agriculture	Wetlands
Millers Run	76.3	6.9	9.8	2.0	Upper Tributaries	67.4	11.2	14.3	1.8
Sleepers River	73.6	6.2	14.7	1.8	West Branch	71.2	6.3	12.9	6.3
Joes Brook	75.1	4.6	8.7	5.0	East Branch	84.4	3.5	4.7	3.4
Lower Tributaries	69.9	11	13.4	1.3	Moose River	82.1	3.1	3.3	5.8

Figure 2. Land cover and major subwatersheds in the Passumpsic River Basin

Climate Change and Implications for the Passumpsic River Basin

Climate is defined by long-term weather patterns, which in turn, influence human and natural systems. The 2014 Vermont Climate Assessment established state-level, climate change information with implications for local surface waters. Since 1941, Vermont average temperatures have increased 2.7° F with warming occurring twice as fast in winter. The latter results in earlier thaw dates for rivers, lakes and ponds, and mountain snowpack. Average annual stream flows are increasing, which is expected to continue in the future. High flows now happen more frequently, leading to increased inundation flooding and fluvial erosion (stream-related erosion.) Additional information on climate change in Vermont can be found at: https://climatechange.vermont.gov.

The impact of increased runoff and streamflow in a watershed depends on local land use and land cover. In developed areas, more precipitation can increase stormwater volume and velocity thereby mobilizing larger pollutant loads (Galford, et al., 2014). In addition, increased streamflow will increase bed and bank erosion and deliver more sediments downstream. In areas where non-point source pollution is a concern more runoff can increase sediment, nutrient, and pathogen loading to surface waters (Galford, et al., 2014). Changes in climate increasingly require watershed restoration projects to preserve natural sediment attenuation locations and incorporate stormwater and non-point source runoff controls to counteract pollutant transport as well as consider the potential for higher peak flows. Restoring floodplain connectivity along streams is essential to provide space for sediment, debris, and nutrients to settle and store naturally and to maintain ecosystem resilience as the climate changes.

Aquatic habitats affected by increased runoff and streamflow could experience increases in sediment mobilization, nutrients and scouring in addition to increased water temperature. In response, local freshwater plant and animal species may shift their geographic ranges and seasonal activities and alter their abundance. Maintaining habitat connectivity, river and lake riparian buffers, and stream equilibrium conditions will help reduce the impacts of climate change on Vermont's rivers, lakes and ponds, and wetlands.

B. Water Quality Conditions in the Passumpsic River Basin

Vermont Assessment Approach

The Vermont Department of Environmental Conservation (VDEC) uses monitoring and assessment data to assess individual surface waters in relation to Vermont Water Quality Standards as outlined in the 2016 VTDEC Assessment and Listing Methodology (VDEC, 2016). Vermont's assessment approach is described in the Vermont Water Quality Monitoring Program Strategy 2011-2020 which was updated in 2015 (VDEC, 2015).

The Passumpsic River Basin Assessment report includes information on biological, chemistry and stream geomorphic conditions in the basin, and specific data for individual sites can be found using the Vermont Integrated Watershed Information System (VIWIS) online data portal. Chapter 4 includes

information on sector specific assessments such as bridge and culvert surveys, stream geomorphic assessments, stormwater master plans and road erosion inventories while the monitoring table in chapter 5 identifies priorities for future monitoring.

The four categories used in Vermont's surface water assessments are **full support, stressed, altered** and **impaired**. For Vermont, impairment is substantiated by chemical, physical or biological data collected through monitoring and these waters are noted on the state's 303(d) list of impaired waters. Aside from the 303(d) list, the State also produces the priority waters list which identifies other waters that do not meet water quality standards but do not require a Total Maximum Daily Load (TMDL). Sections of that list include: Part B- impaired waters that have other required remediation measures in place; Part D- impaired waters with TMDLs in place; Part E-waters altered by aquatic invasive species; and Part F- waters altered by flow modifications. These priority waters can be viewed on the Vermont Environmental Atlas.

For a more detailed description of monitoring results use the Vermont Integrated Watershed Information System online data portal. In addition to this, water quality standards status is displayed on the Vermont Lake Score Card that displays if a lake is impaired, altered or stressed along with nutrient trends, shoreland condition and lake habitat, mercury pollution and invasive species.

Waters that support designated and existing uses and meet water quality standards are placed into the full support or stressed categories. The stressed waters category refers to waters that support uses but where water quality or habitat have been disturbed by point or by nonpoint sources of human origin and the water may require some attention to maintain or restore water quality. Water quality monitoring is also used to identify waters that exceed criteria and are candidates for reclassification to class B(1) or A(1) waters as described in Chapter 2.

Conditions of Lakes and Ponds

Vermont has over 800 lakes or ponds, with 220 of them larger than 20 acres in size. The Passumpsic River Basin hosts only 21 lakes or ponds 10 acres or larger, fewer lakes than most of the other basins in the state. With excellent water quality, intact shoreline, high biodiversity, few invasive species and scenic features, the best lakes in this basin include Bald Hill, Bean, Center and Stannard ponds. These ponds have been identified by Division staff as some of the best lakes in Vermont (in the top 10% statewide). Chandler and Joes ponds rank in the top 20% and Bruce Pond in the top 25%. Bald Hill Pond and Stannard Pond are two of just 13 'sentinel' lakes that have been chosen as research sites to evaluate how climate change is impacting lakes in Vermont. The Passumpsic River Basin is also unique in that there are no reported aquatic invasive species in any lake in the basin as shown in Figure 3. None of the lakes in the basin are considered impaired or altered (poor conditions) for water quality standards status, while over 30% of lake acreage in Vermont is listed as impaired or altered.

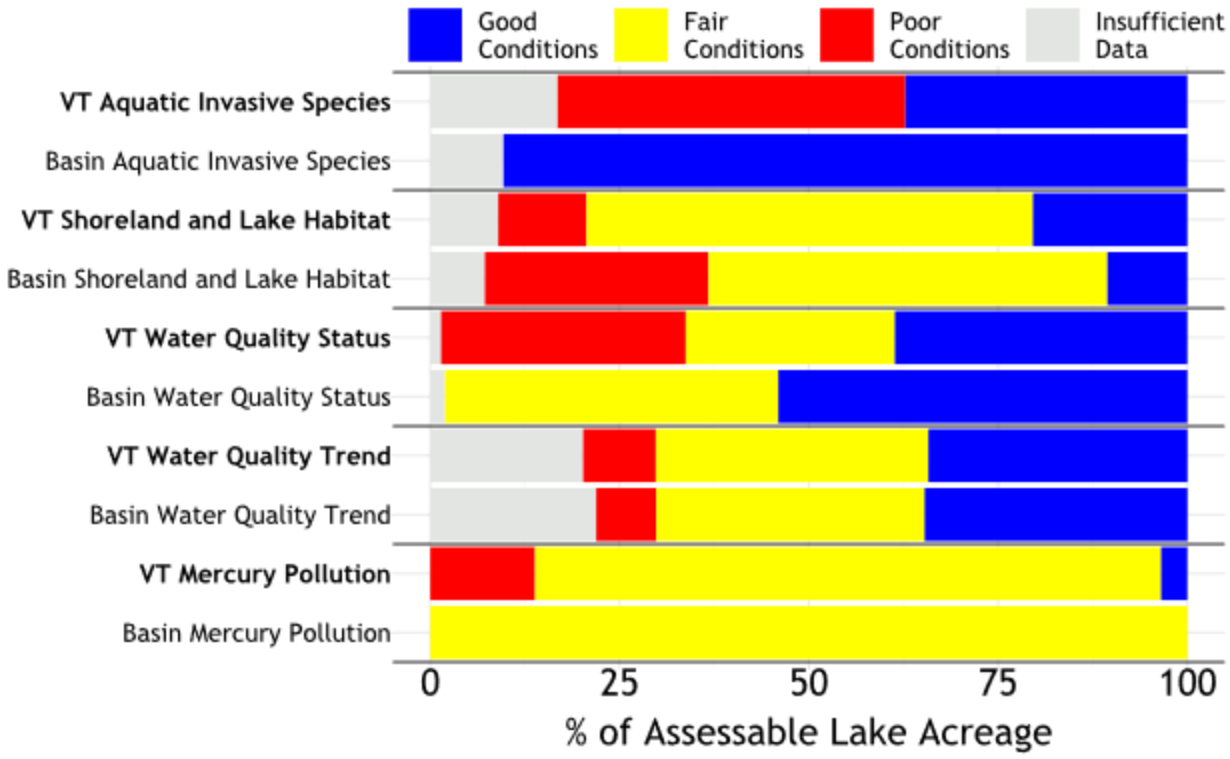


Figure 3. Lake assessment status for lakes in the Passumpsic Basin as compared to the state

On the other hand, the basin has a greater acreage of stressed lakes for water quality status (fair conditions) which are a focus for water quality improvements efforts in the Passumpsic River Basin. Stiles Pond is listed as stressed for organic enrichment with associated low dissolved oxygen levels, Joes Pond has elevated nutrient levels, Cow Mountain Pond and Mud Pond are stressed due to low pH and Sawdust Pond is listed as stressed for sedimentation.

Encroachment, by way of shoreland development, is the greatest stressor to Vermont lakes, as reported in the National Lake Survey study (USEPA, 2016) and this is true for the Passumpsic River Basin which has a higher percentage of lake area with poor shoreland conditions as compared to lakes across Vermont. This includes Joes Pond (poor shoreland condition) and Bald Hill, Stiles, Bean, Chandler, Coles, Duck and Newark ponds (all with fair shoreland condition). Recommendations to improve these conditions are discussed in the shoreland restoration section of Chapter 4.

Lakes in the Passumpsic River Basin have a similar percentage of waters with increasing nutrient trends as compared to lakes statewide. Increasing nutrient, chlorophyll or declining clarity trends have been identified for Joes Pond and Bald Hill Pond. Nutrient sources to Joes Pond may be shoreland development, roads, and agricultural lands, while no clear source of loading to Bald Hill Pond has been identified. All lakes in the Passumpsic River Basin are under a Vermont Department of Health fish consumption advisory for exceeding the USEPA mercury (Hg) limits in fish.

Table 1. Priority Lakes in the Passumpsic River Basin as identified through the Vermont Lake Score Card

Waterbody	Pollutant	WQ problem	Sector	Remediation approach
Stressed and Priority Lakes (Assessment database – Lake Scorecard)				
Bald Hill Pond	Nutrients, Shoreland encroachment	Highly significantly increasing nutrient trend, fair shoreland conditions	Unidentified	Complete a watershed survey in 2019, reevaluate shoreland assessment.as there appears to be limited shoreland development.
Bean Pond	Shoreland encroachment	Fair shoreland conditions	Natural resources - shoreland restoration	Lake wise assessment and implementation
Center Pond	Shoreland encroachment	Fair shoreland conditions	Natural resources - shoreland restoration	Lake wise assessment and implementation
Chandler Pond	Shoreland encroachment	Fair shoreland conditions	Natural resources - shoreland restoration	Reevaluate shoreline assessment
Coles Pond	Shoreland encroachment	Fair shoreland conditions	Natural resources - shoreland restoration	Lake wise assessment and implementation
Cow Mountain Pond	Acid	Stressed due to low alkalinity	Atmospheric deposition	Implement acid TMDL
Duck Pond	Shoreland encroachment	Encroachment	Natural resources - shoreland restoration	Lake wise assessment and implementation
Joes Pond	Nutrients, shoreland encroachment	Elevated phosphorus levels with an increasing nutrient trend, poor shoreland conditions	Agriculture, developed lands—roads, developed lands – stormwater, natural resources - shoreland restoration	Agricultural Best Management Practices (BMPs), buffer planting, road BMPs, lake wise assessment and implementation, stormwater BMPs
Mud Pond (Granby)	Acid	Stressed due to low alkalinity	Atmospheric deposition	Implement acid TMDL
Newark Pond	Shoreland encroachment	Fair shoreland conditions	Natural resources - shoreland restoration	Lake wise assessment and implementation
Sawdust Pond	Sediment	Stressed due to sedimentation		Site visit to identify Source areas
Stiles Pond	Low dissolved oxygen, shoreland encroachment	Stressed due to low dissolved oxygen levels, fair shoreland conditions (due to Route 18)	Developed lands – roads, developed lands – stormwater	Buffer planting, road BMPs, stormwater BMPs

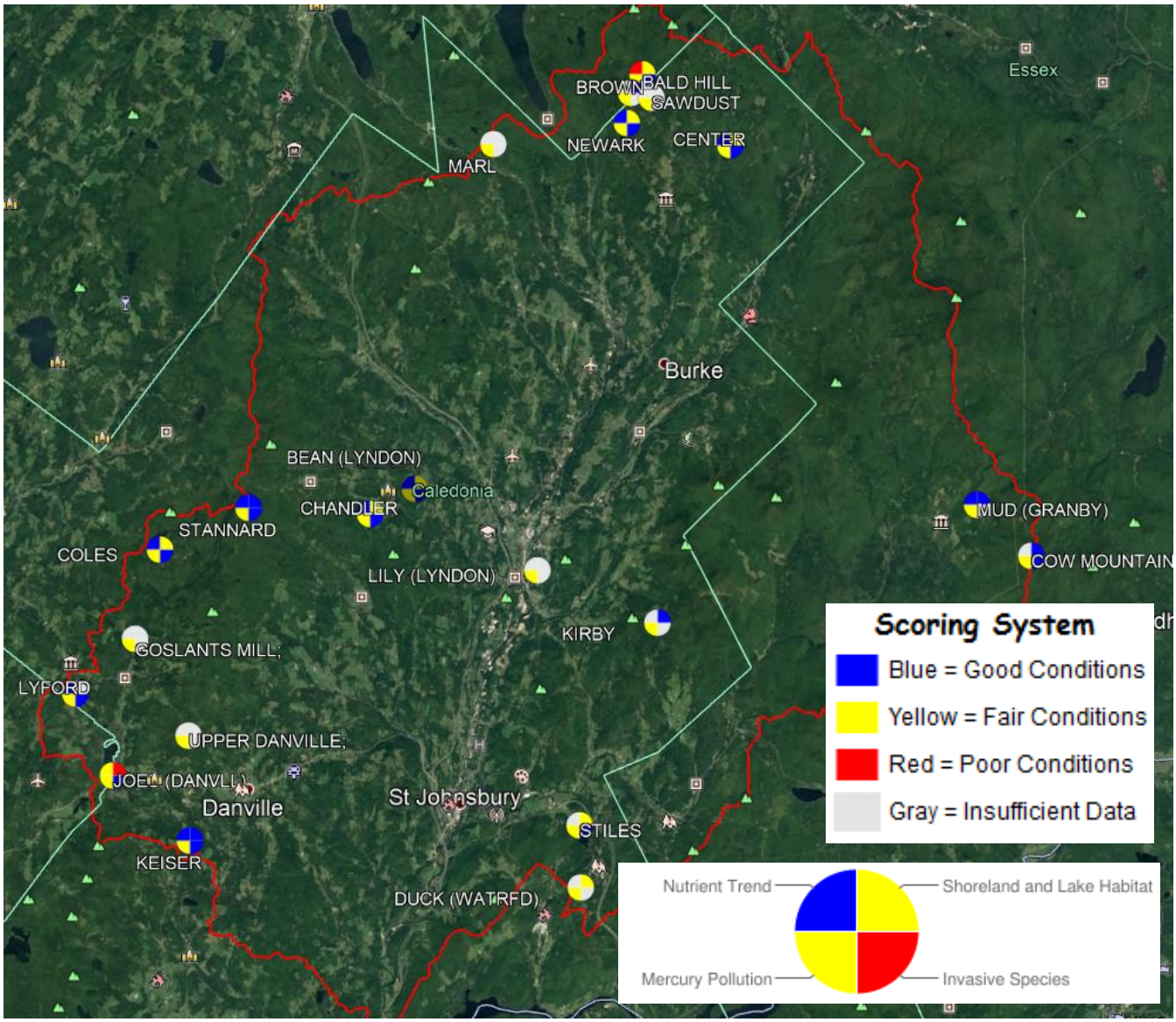


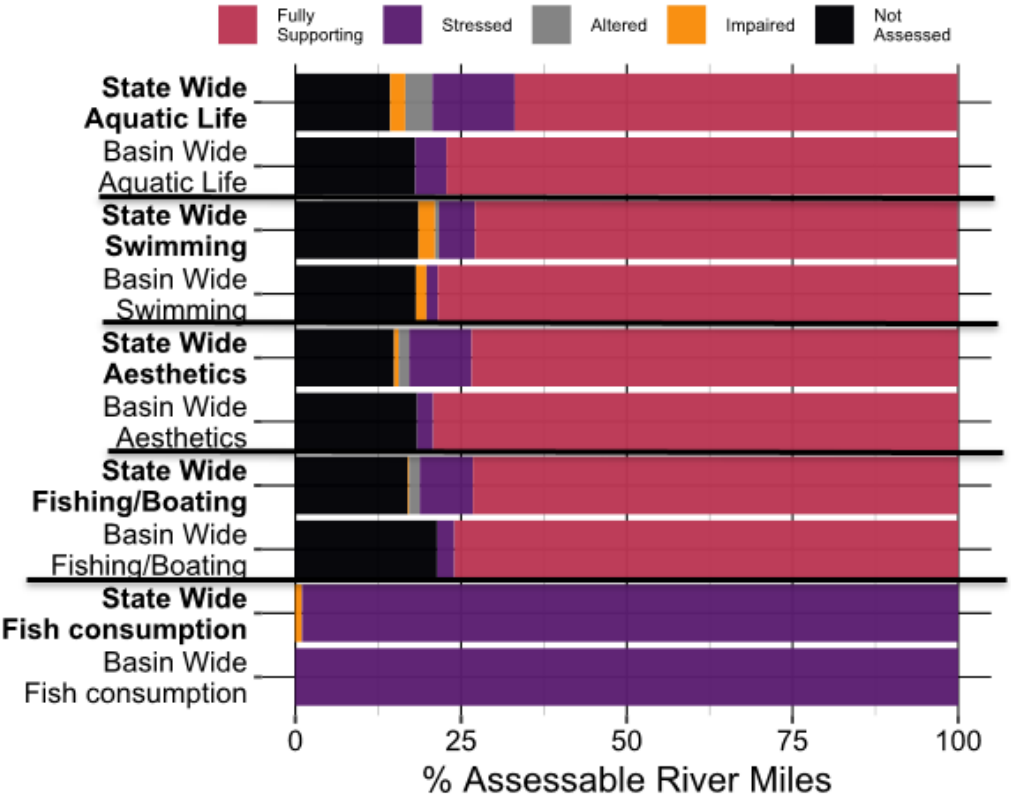
Figure 4. Lake Score Card results for lakes in the Passumpsic River Basin

Conditions of Rivers and Streams

There are fewer impaired or altered rivers in the Passumpsic River Basin as compared to the rest of Vermont as shown in Figure 5. A large percentage of waters in the basin are identified as meeting B(1) criteria for aquatic biota or fishing use and only a short length of river is considered altered. Elevated levels of mercury in fish tissue, driven primarily by atmospheric deposition, has resulted in stressed conditions for fish consumption for all surface waters in the basin and a statewide fish consumption advisory. Based on the length of stressed or impaired waters, pathogens are the next most widespread pollutant in the basin followed by nutrients, sedimentation and other habitat alterations. The most widespread sources of these stressed or impaired conditions are agriculture,

channel instability, combined sewer overflows, municipal point sources, hazardous waste sites and developed lands runoff.

Figure 5. Passumpsic River Basin use support across five uses as compared to the state



The only impairments in the basin are *E. coli* impairments of Passumpsic River and Lower Sleepers River which receive combined sewer overflow from the St Johnsbury combined waste and stormwater system – described in detail in Chapter 4. Individual impaired, altered and stressed Rivers are listed in Table 2 which also identifies the water quality problem, sector, and remediation approach and Figure 6 which maps out the geographical extent of these waters.

Table 2. Rivers on the Vermont 2018 priority waters list (VDEC, 2018) and 2016 stressed water list (VDEC, 2016) for the Passumpsic River Basin

Waterbody	Pollutant	WQ problem	Sector	Remediation approach
IMPAIRED SURFACE WATERS IN NEED OF TMDL (VDEC 2018)				
Passumpsic River – Tremont Street - 5 miles downstream.	*E. coli*	Pathogens	Stormwater - combined sewer overflow (CSO)	Green stormwater infrastructure (GSO) practices and sewer separation practices in CSO watersheds
Lower Sleepers River	*E. coli*	Pathogens	Stormwater - combined sewer overflow (CSO	
STRESSED RIVERS (VDEC 2016)				
Water Andric	Nutrients, enrichment, low dissolved oxygen	Danville WWTF causes high phosphorus levels.	WWTF, Agriculture, Roads, Stormwater.	Ag BMP's, Road practices, Stormwater treatment, WWTF improvements

Waterbody	Pollutant	WQ problem	Sector	Remediation approach
Millers Run	Physical alteration, Sediments	Agricultural land with no buffers, streambank erosion	Agriculture, Streambank Erosion (loss of riparian vegetation), Roads	River corridor protection, outreach on strengthening zoning bylaws, restoration projects
Dish Mill Brook	Sediment, hydrologic alteration.	Scour events from increased peak flows; periodic Sedimentation issues.	Roads, Stormwater	Stormwater and road treatment practices, riparian restoration.
Dish Mill Brook tributary	Sediment	High embeddedness, erosion from parking areas.	Roads, Stormwater.	Stormwater and road treatment practices, riparian restoration.
Chesterfield Valley/ Moose River	*E. coli*	Elevated *E. coli*; ag bmp installed in 2008 with improvement noted	Agriculture	Continue to work with farmer on farmstead and field management. Assess current E. coli levels.
Simpson Brook	Undefined	Impacts to fish community from undetermined sources	Undefined	Watershed assessment.
Sleepers River	Metals, oil	Elevated levels of Ni in sediment, Fairbanks-Morse foundry site: oil spill, other possible contaminants	Stormwater	Continue VDEC biomonitoring, Metals sampling
Unnamed Outlet Stream of Lily Pond in Lyndon	Priority org (tce), metals (in sediment)	Parker landfill received hazardous waste; contaminated groundwater & stream sediments contain metals	Stormwater	VDEC biomonitoring
WATERS ALTERED BY FLOW REGULATION (VDEC 2018)				
Passumpsic River, Below Great Falls Dam (0.1 Miles)	Low and fluctuating flows	Flow Alteration	Artificial flow regime and condition by hydro operations; alters aquatic habitat in bypass reach	Federal Energy Regulatory Commission (FERC) license expires in 2019; in FERC relicensing process where this issue will be considered.

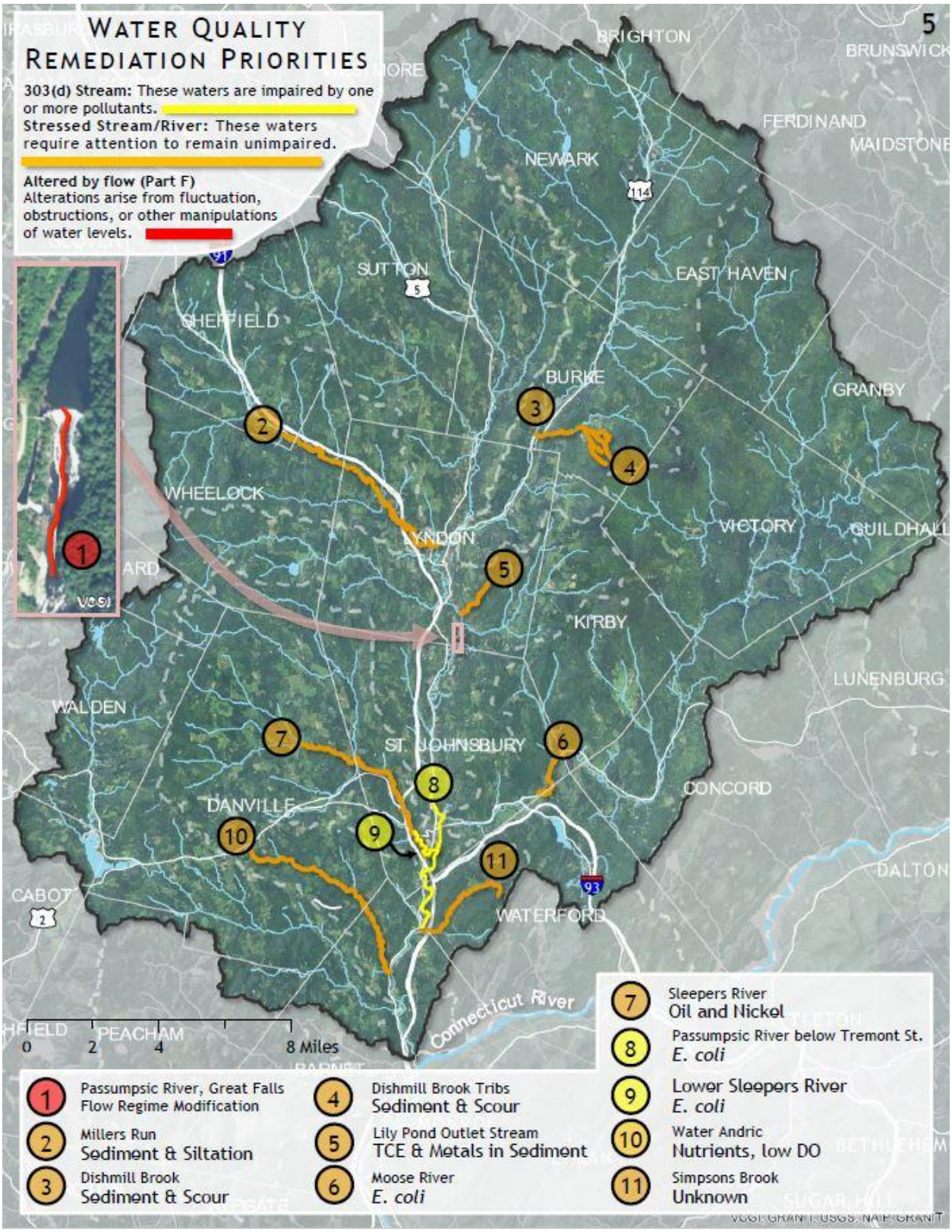


Figure 6. Map of stressed or impaired rivers in the Passumpsic River Basin

Physical alterations are also present throughout the basin, ranging from habitat alteration, general stream channel instability and encroachment into floodplains and river corridors, as well as flow alterations. As compared to statewide geomorphic assessments, the Passumpsic River Basin has less mileage of waters in both poor and reference condition (Figure 7) although the assessed reaches may not be representative of conditions in the basin as a whole. The results of specific assessments are described in greater detail in the river connectivity section of Chapter 4.

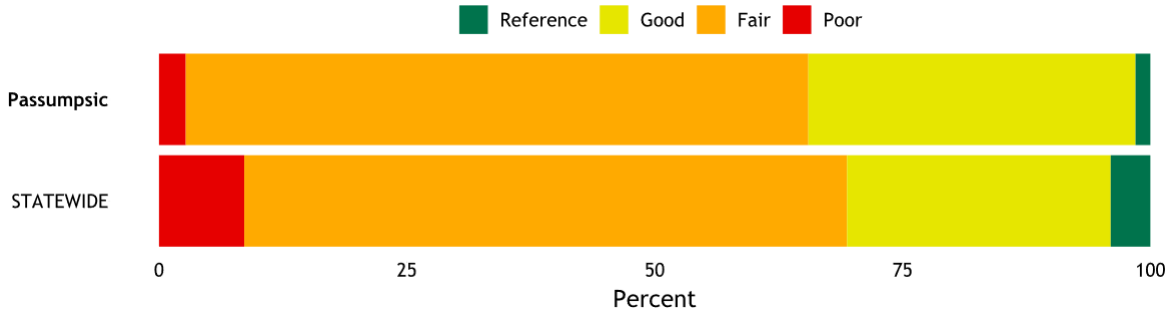


Figure 7. Geomorphic conditions of basin waters as compared to the state

Conditions of Wetlands

The Passumpsic River Basin contains a great diversity of wetlands, ranging from open water habitats to rich forested swamps. The wetlands in the basin are identified on the Vermont Wetlands Inventory Map although up to 39% of Vermont wetlands may not be mapped. More than 35% of the original wetlands in Vermont have been lost. In recent years, residential, commercial and industrial development have been the primary causes of wetland loss.

The USEPA's National Wetland Condition Assessment 2011 survey included Vermont wetlands with assistance from the WSMD Wetlands and Monitoring, Assessment and Planning Programs. The assessment of Eastern Mountains wetlands, including Vermont's, estimated that 52% of the estimated wetland area is in good condition; 11% is in fair condition, and 37% is in poor condition. Presently, the WSMD Wetlands Program is developing a biomonitoring program to measure wetland health to allow assessment of data specific to Vermont. There are a limited number of wetlands assessments that have been completed in the Passumpsic River Basin based on this data it suggests that wetlands in this basin are in better condition than on average for the state as a whole.

Chapter 2 –Surface Water Protection Opportunities

All surface waters in Vermont are managed to support designated uses valued by the public. These uses include swimming, boating, fishing, aquatic biota, aquatic habitat, aesthetics, drinking water source and irrigation. In this section of the plan, several waters are identified as being high quality exceptional, and these, as well as other unique waterbodies, are candidates for establishing enhanced management objectives or augmented protections through one of the processes that are further described below.

Figure 8. Actions identified for water quality protection in the 2019 Passumpsic River TBP. Numbers refer to the number of waterbodies recommended for increased protection.

- Reclassification of surface waters
- Class I Wetland designation
- Outstanding Resource Waters designation
- Designation of waters as cold-water fisheries
- Identification of existing uses

The Vermont Water Quality Standards establish water quality classes and associated management objectives. The protection of water quality and water-related uses can be promoted by establishing specific management objectives for bodies and stretches of water. The management objectives describe the values and uses of the surface water that are to be protected or achieved. In addition to this, strategies to protect forested and riparian lands to support the protection of high quality waters are described in chapters 4 and 5.

The Agency of Natural Resources is responsible for determining the presence of existing uses on a case-by-case basis or through basin planning and is also responsible for classification or other designations which are summarized in Figure 8. Once the Agency establishes a management goal, the Agency manages state lands and issues permits to achieve all management objectives established for the associated surface water.

Before the Agency recommends management objectives through a classification or designation action, input from the public on any proposal is required and considered. The public may present a proposal for establishing management objectives for Agency consideration at any time, while the Agency typically relies on the publication of basin plans to promote reclassification (10 V.S.A. § 1424a). When the public develops proposals regarding management objectives, the increased community awareness can lead to protection of uses and values by the community and individuals.

Public involvement is an essential component to restoring and protecting river and lake ecology. The Vermont Water Quality Standards indicate that in the basin planning process, "*Public participation shall be sought to identify and inventory problems, solutions, high quality waters, existing uses and significant resources of high public interest."* Emphasis on the identification of values and expectations for future water conditions can only be achieved through public contributions to the planning process. The public, watershed partners and stakeholders are encouraged to make recommendations for additional monitoring and research where very high-quality waters appear to exist.

A. Reclassification of Surface Waters

Since the 1960s, Vermont has had a classification system for surface waters that establishes management goal objectives and supporting criteria for each use in each class of water. Pursuant to Act 79 of 2016, the Vermont General Assembly, recognizing the wide range of quality for Class B waters, created a new intermediary water quality class between B(2) and A(1), now called Class B(1). Act 79 also sets forth the expectation that individual uses of waters (e.g., aquatic biota and wildlife, aquatic habitat, recreation, aesthetics, fishing, boating, or swimming) may be individually classified, so a specific lake or stream may have individual uses classified at different levels. Act 79 indicates that uses may be reclassified independently to Class B(1) for individual uses if the quality of those uses are demonstrably and consistently of higher quality than Class B(2). The extent of the water being reclassified is subject to review based on documented conditions.

These waters and their elevated uses are identified through the tactical planning process or on a case by case basis. The current classification of a water does not signify that B(1) criteria are not met. Additional waters suitable for reclassification may be identified in the future as some waters have not been previously monitored. Table 3 lists the possible classes into which each use may be placed.

Table 3. A list of uses that can be placed into each water class in the Vermont Water Quality Standards (VDEC, 2017)

Classification (2016)	Applicable Uses
Class A(1)	One or more of: Aquatic biota and wildlife, aquatic habitat, aesthetics, fishing, boating, or swimming
Class A(2)	Public water source
Class B(1)	One or more of: Aquatic biota and wildlife, aquatic habitat, aesthetics, fishing, or boating
Class B(2)	Aquatic biota and wildlife, aquatic habitat, aesthetics, fishing, boating, swimming, public water source or irrigation

The Vermont Water Quality Standards (VWQS) begin classification with two broad groups based on elevation:

- All waters above 2,500 feet altitude, National Geodetic Vertical Datum, are designated Class A(1) for all uses, unless specifically designated Class A(2) for use as a public water source.
- All waters at or below 2,500 feet altitude, National Geodetic Vertical Datum, are designated Class B(2) for all uses, unless specifically designated as Class A(1), A(2), or B(1) for any use.

Tactical basin plans identify surface waters where monitoring data indicates conditions are significantly better than the water quality objectives and criteria of the VWQS. This high-level of quality may be protected by site-specific application of the anti-degradation policy of the VWQS, or by reclassification to a higher-level designated use.

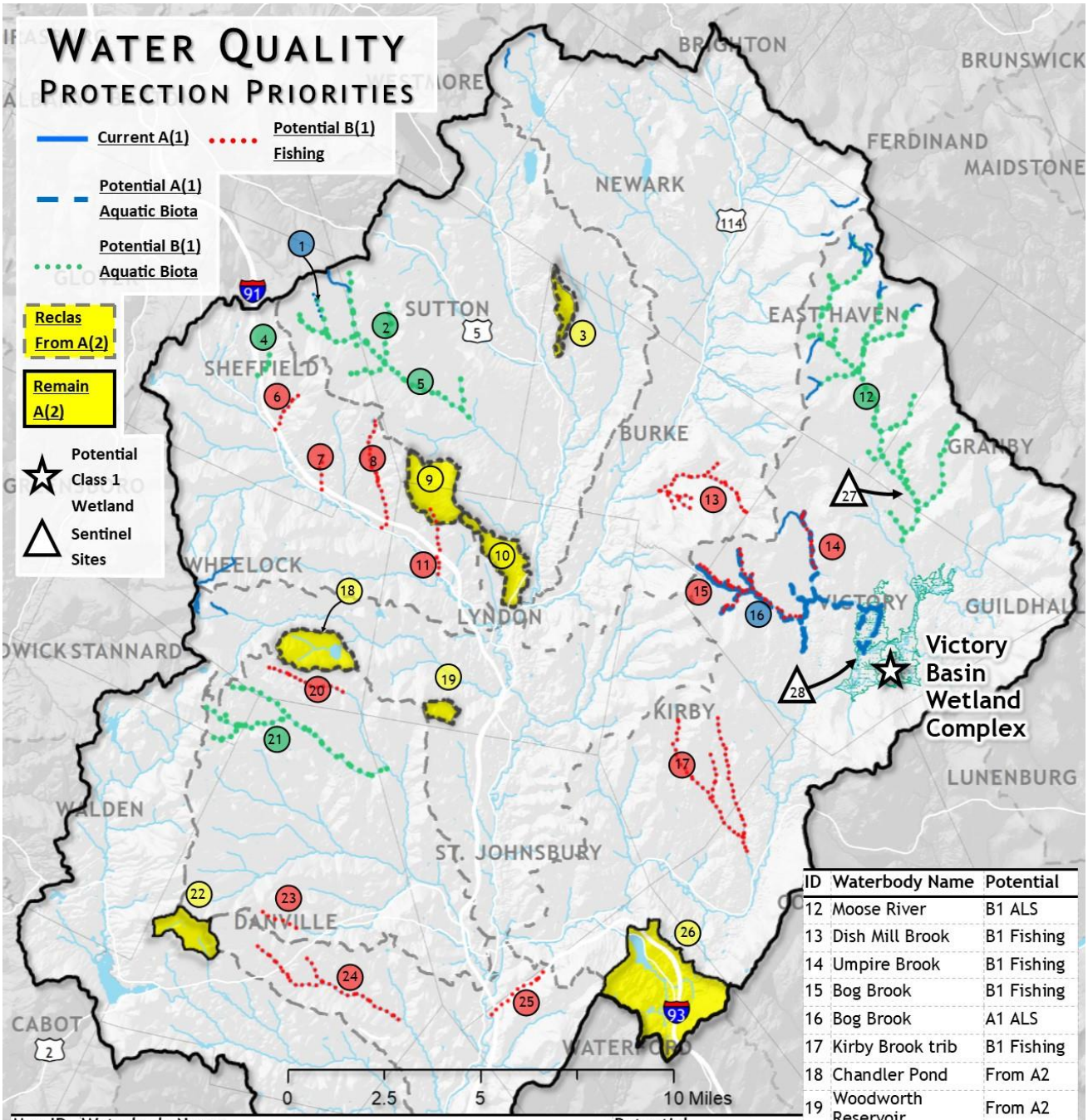
Reclassification is proposed for many surface waters in this Tactical Basin Plan as shown in Figure 9 and tables 4-6. Seven waters are designated as A(2) public water sources in the Passumpsic River Basin. Five of these have been abandoned as public water sources and are recommended to be reclassified to reflect their current condition for each designated use (Table 4).

Table 4. Class A(2) designated public water sources in the Passumpsic River Basin

Map ID	Waters	Water Source	Description
9.	Unnamed tributary to Miller Run including Mathewson Reservoir	Lyndonville	**Abandoned**. Village of Lyndonville water source. Unnamed tributary to Miller Run including Mathewson Reservoir and all waters within their watersheds above the intake in the Towns of Lyndon and Sutton. Recommend reclassification to B(1) or B(2).
10.	Unnamed tributary to Miller Run including Copeland Reservoir	Lyndonville	**Abandoned**. Village of Lyndonville water source. Unnamed tributary to Miller Run including Copeland Reservoir and all waters within their watersheds above the intakes. Recommend reclassification to B(1) or B(2).
18.	Chandler Pond	Lyndonville	**Abandoned**. Lyndonville Village water source. Chandler Pond and all waters within its watershed in the Town of Wheelock. Wheelock Pond drains to the South Wheelock Branch. Recommend reclassification to B(1) or B(2).
19.	Woodworth Reservoir	Lyndonville	**Abandoned**. Lyndonville water source. Woodworth Reservoir and all waters within its watershed in the Town of Lyndon. Woodworth Reservoir flows to the South Wheelock Branch. Recommend reclassification to B(1) or B(2).
3.	Two unnamed tributaries to Sutton River.	West Burke	**Abandoned**. Unknown water source. Two unnamed tributaries to the Sutton River, near West Burke, and all waters within their watersheds above the intakes. Recommend reclassification to B(1) or B(2).
26.	Stiles Pond	St. Johnsbury	**Permanent.** St. Johnsbury Village (WSID 5045) water source. Stiles Pond and all waters within its watershed in the Town of Waterford. Stiles Pond is in the St. Johnsbury municipal forest and flows to the Moose River.
22.	Danville Reservoir.	Danville	**Emergency.** Danville (WSID 5037) water source. Danville Reservoir on tributary of Brown Brook and all waters within its watershed in Danville.

Very High-Quality Waters Supporting Aquatic Biota

Based upon stream biomonitoring assessments conducted by the VTDEC, five surface waters in the Basin consistently and demonstrably attain a higher level of quality than Class B(2), meeting Class B(1) criteria for aquatic biota – but not rising to the level of class A(1). These waters are Clark



Map ID	Waterbody Name	Potential
1	Calendar Brook trib 22	A1 ALS
2	Clark Brook	B1 ALS
3	Two unnamed tributaries to Sutton River	From A2
4	Nation Brook trib 3	B1 ALS
5	Calendar Brook	B1 ALS
6	Miller Run Headwaters	B1 Fishing
7	Dexter Brook trib	B1 Fishing
8	Mathewson Brook	B1 Fishing
9	Unnamed tributary to Miller Run including Mathewson Reservoir	From A2
10	Unnamed tributary to Miller Run including Copeland Reservoir	From A2
11	Unnamed tributary to Miller Run	B1 Fishing

ID	Waterbody Name	Potential
12	Moose River	B1 ALS
13	Dish Mill Brook	B1 Fishing
14	Umpire Brook	B1 Fishing
15	Bog Brook	B1 Fishing
16	Bog Brook	A1 ALS
17	Kirby Brook trib	B1 Fishing
18	Chandler Pond	From A2
19	Woodworth Reservoir	From A2
20	Burroughs Brook	B1 Fishing
21	Houghton Brook	B1 ALS
22	Danville Reservoir	Remain A2
23	Whiteman Brook trib	B1 Fishing
24	Water Andric	B1 Fishing
25	Unnamed trib To Passumpsic	B1 Fishing
26	Stiles Pond	Remain A2
27	Moose River	Sentinel
28	Bog Brook	Sentinel

Figure 9. Recommended and existing high-quality waters of the Passumpsic River Basin

Brook, Nation Brook Tributary 3, Houghton Brook and the Upper Moose River. Through the rulemaking process which provides opportunities for public comment and input, these waters are recommended for reclassification to B(1). Two waters, Clark Brook Trib 22 and Bog Brook consistently and demonstrably meet Class A(1) criteria for aquatic biota and are recommended for reclassification to A(1). Thirteen additional sites are recommended for additional sampling to confirm eligibility for B(1) for aquatic biota as listed in monitoring priorities table (Table 13.) Bog Brook and the Upper Moose River are two of just 12 sentinel stream monitoring sites statewide which are monitored regularly to look at the effects of climate change. Reclassification of these waters as recommended would offer further protection for these reference waters.

Table 5. Waters meeting A(1) and B(1) criteria for Aquatic Biota based on data through 2018

ID	Stream Name	Town	Reclassification opportunity
1.	Bog Brook	Burke, Victory	A(1)
2.	Calendar Brook Tributary 22	Sheffield	A(1)
3.	Calendar Brook	Sutton, Sheffield	B(1)
4.	Clark Brook	Sheffield, Sutton, Burke, Lyndon	B(1)
5.	Nation Brook Tributary 3	Sheffield	B(1)
6.	Moose River	Victory, Granby, East Haven	B(1)
7.	Houghton Brook	Walden, Stannard, Danville	B(1)

Very Good Waters for Recreational Fishing

Certain waters in the Passumpsic River Basin support productive noteworthy populations of cold-water salmonids. Rivers and streams classified as B(1) recreational fishing waters, support wild, self-sustaining salmonid populations characterized by the presence of multiple age classes and a minimum abundance of 1000 individuals per mile (all species/ages/sizes); and/or 200 large (> 6 inches total length) individuals per mile; and/or 20 pounds/acre (all species/ages/sizes)[1]. Table 6 lists the names of streams that meet B(1) criteria for recreational fishing (§29A-306), which are also displayed in Figure 9.

These waters shall be managed to achieve and maintain very good quality fishing. The list in Table 6 may be adjusted in the future based on new and updated surveys and as protocols are refined. Waters that meet the revised criteria in the water quality standards for both B(1) and A(1) fishing use will be continually identified and updated. Twelve streams identified as requiring one more round of

[1] It should be recognized that wild trout populations vary widely from year to year and therefore an individual population may sometimes go below or greatly exceed these values in any given year. Because of these fluctuations, two years of data are needed to support reclassification within the last 20 years – with at least one sampling with in the last 10 years above the criteria. Alternatively, one year of data may be used if populations meet any of the following criteria: 3000/mile, 400/mile (≥6 inches) or 40 pounds/acre. The upstream and downstream extent of the stream classification should be based upon consistent or improving water quality, physical habitat quality and land use conditions. The reach should include all upstream habitats which are deemed essential to sustain water quality and physical habitat requirements necessary to support wild salmonid populations at a very good level.

sampling to support reclassification are listed in Table 13 on Page 64. It is important to note that all waterbodies that would naturally support fish populations are protected and maintained in perpetuity.

Table 6. Waters meeting B(1) criteria for recreational fishing in the Passumpsic River Basin based on data through 2018

ID	Stream Name	Elevation (meters)	Town	Trout Species Present		
				Brook	*Brown*	*Rainbow*
1.	Burroughs Brook	337	Danville, Wheelock	x		
2.	Dexter Brook	285	Sheffield, Wheelock	x		
3.	Dish Mill Brook	326	Burke	x		
4.	Kirby Brook	287	Concord, Kirby	x		
5.	Mathewson Brook	263	Wheelock, Sheffield	x		
6.	Millers Run Headwaters	323	Sheffield	x		
7.	Umpire Brook	415	Victory	x		
8.	Unnamed trib to Millers Run	256	Lyndon	x		
9.	Unnamed trib to Passumpsic	168	St. Johnsbury	x		
10.	Water Andric	213	Barnet, Danville	x		
11.	Weir Mill Brook	410	Victory, Burke	x		
12.	Whiteman Brook	428	Danville	x		

B. Outstanding Resource Waters Designation

In 1987, the Vermont Legislature passed Act 67, "An Act Relating to Establishing a Comprehensive State Rivers Policy." A part of Act 67 provides protection to rivers and streams that have "exceptional natural, cultural, recreational or scenic values" through the designation of Outstanding Resource Waters (ORW). Depending on the values for which designation is sought, ORW designation may protect exceptional waters through permit conditions in stream alteration, dams, wastewater, aquatic nuisance control, solid waste disposal, Act 250 permits. ORWs are waters which can be designated by the Agency of Natural Resources through a petition process. ORWs display outstanding qualities that are determined to deserve a higher level of protection. There are currently no ORW designations in the Passumpsic River Basin or recommendations in this plan for new ORW designations.

C. Class 1 Wetland Designation

It is policy of the State of Vermont to identify and protect significant wetlands and the values and functions they serve in such a manner that the goal of no net loss of such wetlands and their functions is achieved. Based on an evaluation of the extent to which a wetland provides functions and values, it is classified at one of three levels:

- **Class I**: Exceptional or irreplaceable in its contribution to Vermont's natural heritage and therefore, merits the highest level of protection
- **Class II**: Merits protection, either taken alone or in conjunction with other wetlands
- **Class III**: Neither a Class II or Class I wetland

Impacts to Class I wetlands may only be permitted when the activity is necessary to meet a compelling public need for health or safety. The VT Wetlands Program has created a Class I website with an interactive map. This website includes the determinations for eight Class I wetlands: Dorset Marsh, Northshore Wetland, Tinmouth Channel, Chickering Fen, Dennis Pond Wetlands, Sandbar Wetlands, Peacham Bog and the LaPlatte River Wetlands. The last five wetlands were added since 2016.

The VT Wetlands Program welcomes recommendations for Class I candidates. There are currently no Class I wetlands in the Passumpsic River Basin, however Victory Basin Wetlands Complex in Victory is recommended for Class I designation. Victory Basin is a remarkable boreal wetland complex in northeastern Vermont. While it is smaller than the similar Nulhegan Basin, it supports a large, intact wetland complex with a high variety of natural community types and significant plant and animal diversity. Nearly all of the wetland is in a Wildlife Management Area. All wetland functions and values as tracked by the Vermont Wetland Program are provided at a significant level by this wetland.

This wetland is one of the centerpieces of Vermont's natural environment, and is well known by naturalist groups, scientists, hunters, birdwatchers, anglers and other wetland-interested groups. The wetland is on public land and the thick vegetation and challenging terrain offer a wilderness experience unusual in Vermont for those who choose to stray off the main trails. Anglers target the remoteness of the fishery as a unique opportunity to catch large and abundant Brook Trout in the Bog Brook and Umpire Brook that drain into the complex. The Moose River as it flows though the wetland offers one of the best canoe trips in the state and chances to see a moose in its natural habitat.

As one of the coldest places in the state, the wetland also offers refugia to cold-affinity species in the face of climate change that might be extirpated from the state entirely without access to this wetland and the Nulhegan Basin wetlands. The abundance of peaty soils in the bogs, beaver wetlands, and conifer swamps also sequester a tremendous amount of carbon. Past land use has affected the wetland, but it is recovering well over time. Invasive species are uncommon and beavers have implemented 'restoration projects' that have largely flooded the old railroad bed passing through the wetland and despite past land use there are a handful of small patches of forested wetland with very old trees that have apparently never been logged. Given protection, the condition of the wetland is likely to continue to improve further over time.

As part of the implementation of this tactical basin plan, the Department will hold a site visit to the wetland complex in the spring or summer of 2019 in coordination with VFWD staff to evaluate reclassification opportunities and potential boundaries for a Class 1 wetland. If this site visit confirms wetland complex satisfies criteria for designation, the Department will compile information

and initiate discussions with the community and stakeholders about reclassification. If these efforts determine that the wetland complex satisfies criteria for designation it may be proposed for such designation through departmental rulemaking authority, and as consistent with the Vermont Wetland Rules.

D. Identification of Existing Uses

The Agency may identify existing conditions, known as existing uses, of waters during the tactical basin planning process or on a case-by-case basis during application reviews for State or federal permits. Consistent with the federal Clean Water Act, the Vermont Water Quality Standards have always stipulated that existing uses may be documented in any surface water location where that use has occurred since November 28, 1975. Pursuant to the definition of the new Class B(1) in Act 79, the Agency may identify an existing use at Class B(1) levels when that use is demonstrably and consistently attained. The public is encouraged to recommend waters for existing uses for swimming, boating, fishing, drinking water, and ecological significance given that they provide evidence of such use.

The existing uses identified by VTDEC for the Passumpsic River Basin to date should be viewed as only a partial accounting of known existing uses based upon limited information. The list does not change protection under the Clean Water Act or Vermont Water Quality Standards for waters not listed. The existing uses in the Passumpsic River Basin for swimming, boating, and drinking water supply are found in Appendix A. New recommendations for these existing uses should be sent to the Passumpsic River Watershed Coordinator for review.

It is the Agency's long-standing stipulation that all lakes and ponds in the basin have existing uses of swimming, boating and fishing. Likewise, the Agency recognizes that fishing activities in streams and rivers are widespread throughout the state and are too numerous to thoroughly document for the Passumpsic River Basin. Also recognized is that streams too small to support significant angling activity provide spawning and nursery areas, which contribute to fish stocks downstream where larger streams and rivers support a higher level of fishing activity. As such, along with the larger streams and rivers that support a higher level of fishing activity, these small tributaries are considered supporting the use of fishing and are protected at a level commensurate with downstream areas.

For existing uses of waters, the level of water quality necessary to protect those existing uses shall be maintained and protected regardless of the water's classification (VDEC, 2017).

Chapter 3 –Priority Areas for Surface Water Restoration

A. Basin Specific Total Maximum Daily Loads (TMDLs)

A TMDL or Total Maximum Daily Load is the calculated maximum amount of a pollutant that a waterbody can receive and still meet Vermont Water Quality Standards. In a broader sense, a TMDL is a plan that identifies the pollutant reductions a waterbody needs to meet Vermont's Water Quality Standards and develops a means to implement those reductions. TMDLs can be calculated for reducing water pollution from specific point source discharges or for an entire watershed to determine the location and amount of needed pollution reductions.

Under Section 303(d) of the Federal Clean Water Act, all states are required to develop lists of impaired waters. The list includes impaired lakes, ponds, rivers and streams that do not meet Water Quality Standards. For Vermont, impairment is substantiated by chemical, physical or biological data collected through monitoring and these waters are noted on the state's 303(d) list of Impaired Waters. The Federal Clean Water Act requires TMDLs to be developed for waters on the list; the list provides a schedule indicative of TMDL completion priority.

TMDLs for the Passumpsic River Basin include:

- Long Island Sound (LIS) Dissolved Oxygen TMDL
- Northeast Regional Mercury Total Maximum Daily Load

The Long Island Sound (LIS) Dissolved Oxygen TMDL, released in 2000, is designed to address low dissolved oxygen or hypoxia in Long Island Sound bottom waters. It is often referred to as the Connecticut River Nitrogen TMDL because it is linked to an overabundance of nitrogen discharging into the Sound from the Connecticut River and other tributaries. While nitrogen is essential to a productive ecosystem, too much nitrogen fuels the excessive growth of algae. When the algae die, they sink to the bottom, where they are consumed by bacteria. The microbial decay of algae and the respiration of oxygen-breathing organisms use up the available oxygen in the lower water column and in the bottom sediments, gradually reducing the dissolved oxygen concentration to unhealthy levels.[2]

In 2013, a Vermont-specific section was added to the LIS-TMDL to address four goals.

- First, to identify the Vermont sources of nitrogen as they are currently understood, across broad land use sectors, such as developed, agricultural and forested;
- Second, to identify the current status and trends of important drivers of nitrogen export such as the intensity of agricultural and development activities and investigate how these might have changed since the TMDL baseline time period of 1990;

[2] A Total Maximum Daily Load Analysis to Achieve Water Quality Standards for Dissolved Oxygen in Long Island Sound

- Third, to identify the management programs, operating at that time, that address these drivers of nitrogen loading that have a significant effect on reducing or preventing nitrogen export. A part of this is to identify a timeline as to when programs were initiated or enhanced; and
- Fourth, using a weight-of-evidence approach, to assess the combined management programs/projects to develop a qualitative evaluation as to whether management efforts are sufficient to meet the original 2000 TMDL of a 10% NPS nitrogen reduction and if these actions are sufficient to maintain that control into the future. [3]

A USGS report found loading of nitrogen of 1610 and 1890 pounds per square mile per year from the Moose River at Victory and Passumpsic River at Passumpsic respectively. These rates of loading are lower than the estimated loading from the Connecticut River watershed above Thompsonville Connecticut, at 2230 pounds per square mile per year, but higher than other subwatersheds, suggesting that levels of nitrogen loading are intermediate even though much of the basin is forested (Deacon, 2006).

Loading of nitrogen in the Connecticut River watershed has also been modeled through the Spatially Referenced Regressions on Watershed Attributes (SPARROW) model by the New England Interstate Water Pollution Control Commission and USGS presented in a publication by Richard Moore (Richard Bridge Moore, 2004). This modeling included estimated loading from municipal

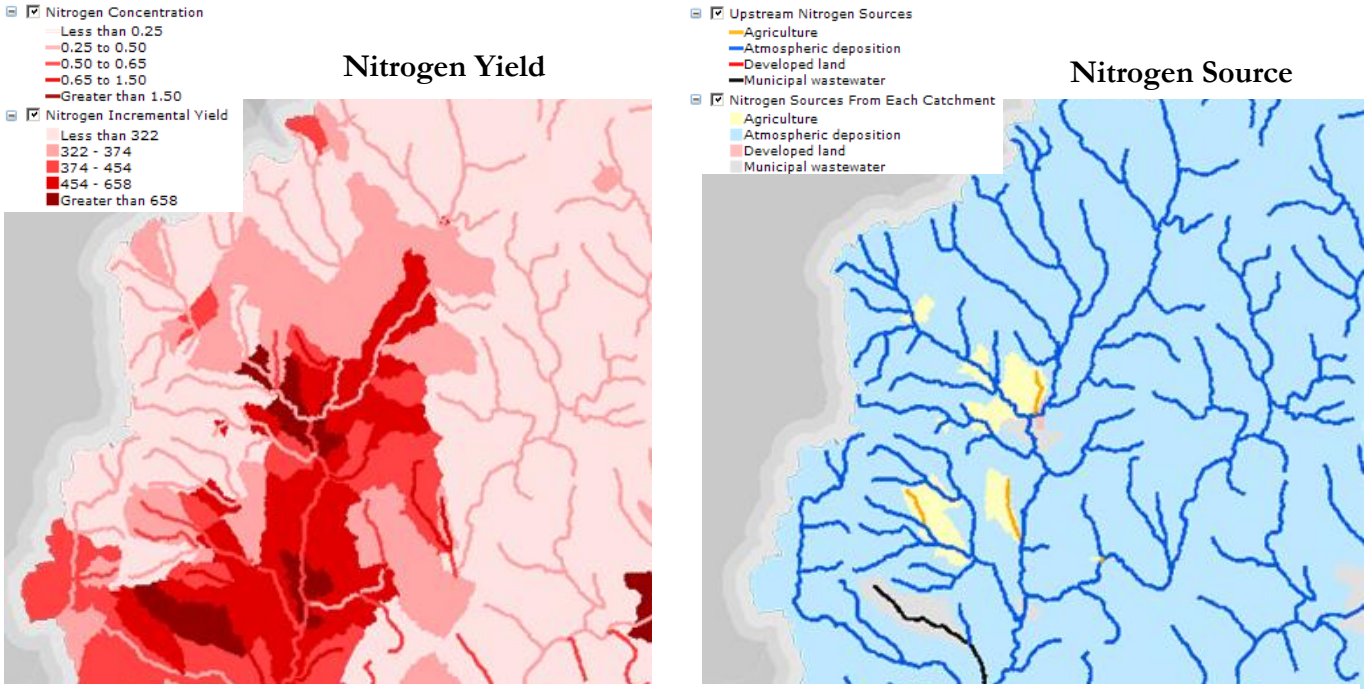


Figure 10. a. Subwatershed nitrogen yield for the Passumpsic River subwatersheds b. Primary nitrogen sources for subwatersheds along with upstream nitrogen sources showing dominance of atmospheric deposition as a nitrogen source in the Passumpsic River watershed (graphics taken from Connecticut River Atlas).

[3] Vermont Enhanced Implementation Plan for the Long Island Sound TMDL

discharges, agricultural, developed lands along with atmospheric deposition with additional calculations for watershed and in stream nitrogen loss. This model estimated Vermont nitrogen export to LIS to be about 4% of the total load to the Sound with approximately 21% of Vermont's nitrogen export originating from agricultural areas, 9% from Municipal Wastewater and approximately 4% originating from developed areas. Of note is that approximately 65% of the nitrogen exported from Vermont originates as atmospheric deposition. Also, worth noting, is that this model was calibrated based on loading data from 1992 and 1993 or earlier so in addition to the typical uncertainties for a model the passage of a quarter of a century adds uncertainty in using this model to understand current nitrogen loading levels.

The LIS Nitrogen TMDL included a provision to re-evaluate and revise the TMDL at a later date. That process is currently underway by a workgroup comprised of representatives of the five watershed states (Connecticut, Massachusetts, New Hampshire, New York and Vermont), EPA, and NEIWPCC. The workgroup is considering many source categories for possible nitrogen reductions and is evaluating management strategies for achieving those reductions. In 2017, EPA embarked on its Nitrogen Reduction Strategy to investigate and better define control actions to reduce nitrogen in the Long Island Sound. Information on the most current developments and strategies can be found in EPA's Long Island Sound Study, a summary is provided below:

> *EPA is implementing a strategy to aggressively continue progress on nitrogen reductions, in parallel with the States' continued implementation of the 2000 Total Maximum Daily Load (TMDL), and achieve water quality standards throughout Long Island Sound and its embayments and near shore coastal waters. The strategy recognizes that more work must be done to reduce nitrogen levels, further improve dissolved oxygen (DO) conditions, and address other nutrient-related impacts in Long Island Sound. The nitrogen reduction strategy complements the 2000 TMDL in important ways. Foremost, while the 2000 TMDL is premised on achieving water quality standards for DO in the open waters of LIS, the EPA strategy expands the focus to include other nutrient-related adverse impacts to water quality, such as loss of eelgrass, that affect many of LIS's embayments and near shore coastal waters.*

The sources of nitrogen to be addressed in Vermont include wastewater discharges, agricultural lands, developed lands and forest practices as shown in Figure 10. Overarching strategies and the steps Vermont is taking to implement these by enacting Act 64 in 2015 include:

- *Continue implementation of nitrogen reductions from wastewater treatment plants (WWTPs), including capping WWTP nitrogen loads, monitoring nitrogen discharged from WWTPs, and the completion of nitrogen removal optimization studies at WWTFs in the VT portion of the LIS watershed.* The development of targets for nitrogen reduction is underway. Discharge permits are being reviewed and updated as part of the permit renewal process.
- *Control non-point source discharges from agricultural lands through implementation of Required Agricultural Practices (RAP) and Best Management Practices (BMP) to decrease sediment and nutrient runoff.* RAPs have been updated and implemented to include increased requirements for small farm certification, increased buffer zones, livestock exclusion, additional nutrient management,

and tile drainage. Additional requirements include inspections of small certified farms; requirements for training farm owners or operators regarding: prevention of discharges to waters; mitigation of stormwater runoff; land application of manure or nutrients; and nutrient management planning; and certification of custom applicators land-applying manure or nutrients.

- *Continue implementation of state stormwater permits covering construction, roads, direct and indirect discharges.* Activities that require an ANR stormwater permit have been expanded to include: construction of one acre or more of impervious surface; discharge from industrial facilities; municipal separate storm sewer systems; earth disturbance of one or more acres; expansion of existing impervious surface by more than 5,000 square feet if the resulting impervious area is more than one acre; runoff from municipal and state roads; and retrofitting of old impervious surfaces.
- *Decrease discharges from forestry practices through continued implementation of AMPs, outreach and the use of portable skidder bridges.* VDFPR has revised the Acceptable Management Practices for Maintaining Water Quality on Logging Jobs (AMPs).

The Long Island Sound Watershed Regional Conservation Partnership Program (LISW-RCPP) was created in 2015 across six states to coordinate the development and implementation of a comprehensive working lands program with foci on: 1) nutrient management and soil health, 2) protection of non-industrial forest habitat, biodiversity, and drinking water sources, and 3) stem erosion and improve resiliency on working lands through riparian restoration.

In partnership with the Vermont Association of Conservation Districts (VACD), UVM Extension, the Connecticut River Conservancy, The Nature Conservancy and federal, state and local organizations in NH, MA, CT, NY and RI, ten million dollars is being invested in the adoption of best management practices on private working lands, providing both technical and financial assistance.[4]

B. Targeted watershed areas for Restoration

By combining the list of high quality waters identified for protection, the priority waters list and those TMDL watershed acres identified as sources, the following focus areas have been identified for restoration and protection across each land use sector. Details about the strategies are discussed for each sector in Chapter 4 with additional information in the implementation table in Chapter 5.

[4] LISW-RCPP website at: http://www.lisw-rcpp.com/home.html

Table 7. Focus areas for implementation of water quality projects by sector in the Passumpsic River Basin

Sector	Focus Areas	Strategies
Agriculture	Joes Pond, Water Andric, Chesterfield Valley, Millers Run, Cropland areas	• Support regional agricultural working group • Hold annual soil health, BMP and/or RAP workshops for farmers • Support farmers in developing and implementing Nutrient Management Plans (NMPs) • Initiate a regional equipment sharing program • Increased buffers, river corridor and wetland restoration outreach and implementation • Water quality monitoring to understand nitrogen source areas
Developed Lands - Stormwater	St Johnsbury CSO watersheds, Water Andric, Joes Pond, Stiles Pond, Dish Mill Brook	• Implement GSI in St. Johnsbury CSO watersheds • Implement priority practices from Stormwater Master Plans • Develop and implement GSI practices at local schools • Support brownfields restoration efforts • Identify stormwater treatment practices in Danville
Developed Lands - Roads	Water Andric, Dish Mill Brook, Joes Pond, Center Pond, Stiles Pond	• Complete REI's and provide technical support for towns to use. • Support for towns in applying for funding to target WQ issues • Address Class 4 WQ issues with support from NWSC • Host Workshops and Peer to Peer sharing on BMP's • Shared Lyndon/Burke and Sutton/Sheffield Hydro seeder
Natural Resources Restoration – Forestland	Bald Hill Pond, A(1) and B(1) watersheds	• Support forestland conservation and skidder bridge program • Promote AMPS, implementation of Voluntary Harvesting Guidelinesand restoration projects on state lands
Natural Resources Restoration – Lakeshore	Joes, Bald Hill, Center, Chandler, Coles, Duck, Newark Ponds	• Support Lake Wise planning, assessment and implementation • Support Aquatic Invasive Species spread prevention efforts
Natural Resources Restoration – River Connectivity	Water Andric, Millers Run, East Branch Passumpsic,	• Develop and implement projects from river corridor plans • Restore floodplain access and stream stability through active projects or river corridor easements & buffer planting projects • Remove obsolete dams and discuss removal of USGS weirs • Strategic wood additions in the upper Moose River tributaries and other locations where this is identified by VFW. • Provide outreach to communities on floodplain and river corridor protections
Natural Resources Restoration – Wetlands	Victory Basin Wetlands Complex	• Wetland reclassification

Chapter 4 –Strategies to Address Pollution by Source Sector.

Tactical basin plans address water quality by sector as summarized in the following sections which are consistent with the CWIP Clean water investment report (State of Vermont Treasurer, 2019).

Agriculture

- Installation or application of conservation practices that reduce sources of pollution from farm production areas and farm fields.

Developed Lands--Stormwater

- Installation of practices that reduce or treat polluted stormwater runoff from developed lands, such as parking lots, sidewalks, and rooftops.

Developed Lands--Roads

- Installation of stormwater and roadside erosion control practices that prevent erosion and treat road-related sources of pollution.

Wastewater

- Improvements to municipal wastewater infrastructure that decrease pollution from municipal wastewater systems through treatment upgrades, combined sewer overflow (CSO) abatement, and refurbishment of aging infrastructure.

Natural Resource Restoration

- Restoration of “natural infrastructure” functions that prevent and abate pollution. Natural infrastructure includes: floodplains and river channels, lakeshores, wetlands, and forest lands.

A. Agriculture

A little over 10 percent of the Passumpsic River watershed is in agricultural land use (Figure 2). Agriculture can both positively and negatively affect water quality. Farms support food production and agricultural land with good soil health absorbs more precipitation, allows for floodplain access during high water flows, and removes nutrients through crop uptake. On the other hand nutrients, pathogens, and sediments can be exported from farms when waste storage facilities don't function property or when rain or floodwaters wash sediment, manure or fertilizer from fields and farmstead areas or cause field or streambank erosion.

Runoff from agricultural lands has been identified as a contributor to four of the watersheds in the basin with water quality concerns. These water quality concerns include *E. coli* in the Chesterfield Valley Brook, nutrient loading in Joes Pond and the Water Andric, and instability of Millers Run due in part to agriculture as shown in Figure 11. Agricultural runoff also contributes nitrogen from the Passumpsic River Basin to Long Island Sound which is a concern due to low dissolved oxygen levels. Conversely, the South Wheelock, Calendar Brook, and Sleepers River watersheds have significant numbers of farms and acreages of agricultural land use, and streams in these watersheds consistently meet Class B(2) standards. Several tributaries in these watersheds are streams that are better than Class B(2) standards which are candidates for reclassification to B(1) as described in Chapter 2.

This section presents basin-specific strategies to address agricultural water resource impairments through regulatory programs, best management practice (BMP) implementation, funding sources, outreach efforts, and partnerships. The tactical basin planning approach engages local, regional, and federal partners in the development of these strategies needed to accelerate agricultural BMPs to meet the state's clean water goals including reductions to support the Long Island Sound (LIS) Nitrogen TMDL. This section is organized around the Vermont Agency of Agriculture, Food, and Markets (VAAFM) regulatory programs including the Required Agricultural Practices (RAPs), the Large Farm Operations Program (LFO) generally regulating farms with 700 or more dairy cows or equivalent, the Medium Farm Operations Program (MFO) regulating farms with 200-699 dairy cows or equivalent and the Certified Small Farm Operations Program (CSFO) which regulates farms with 50 – 199 dairy cows or equivalent or 50 acres of cropland or vegetables. The chapter concludes with a discussion of the available agricultural assistance and outreach programs and local coordination efforts.

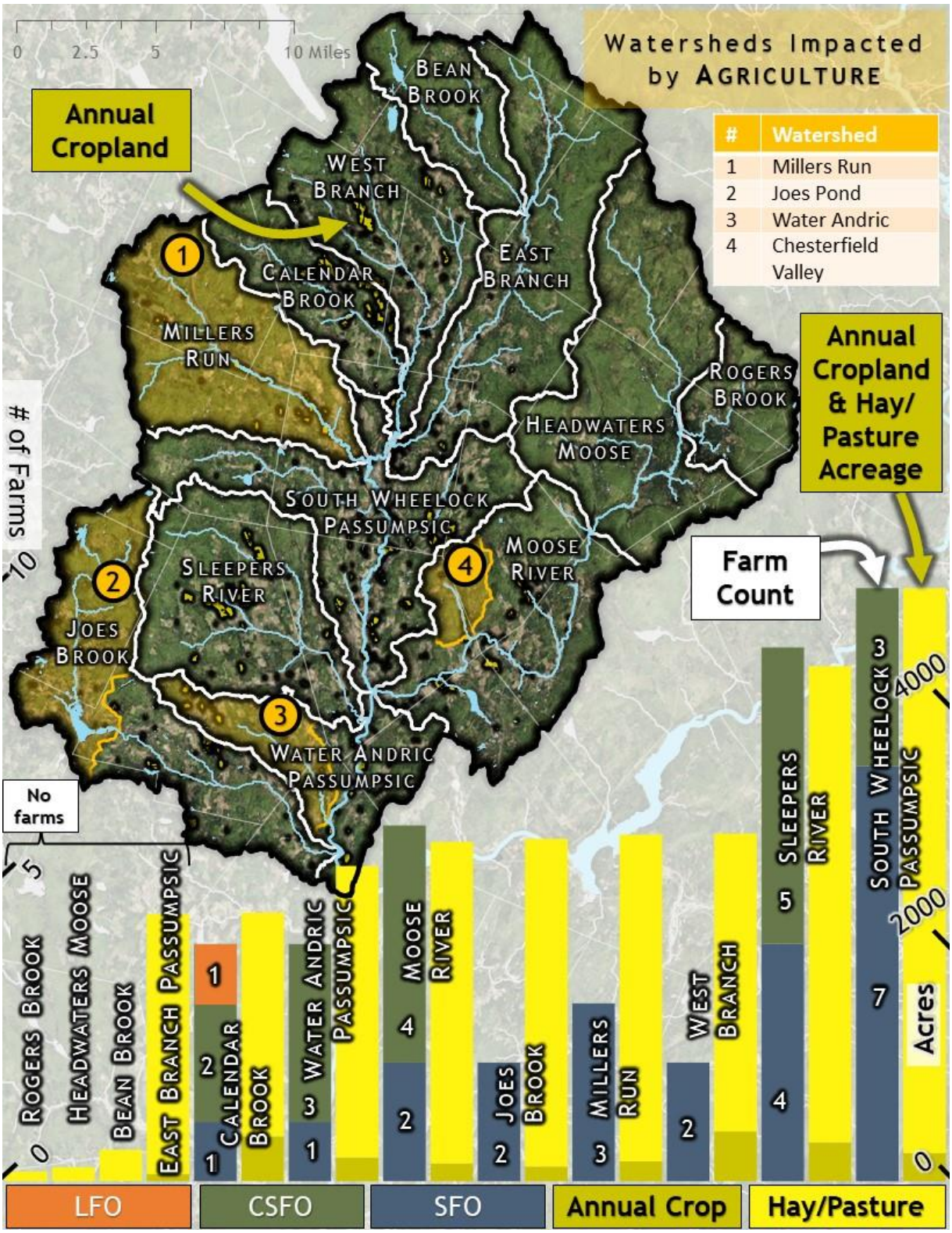


Figure 11. The map shows annual cropland across the HUC 12 watersheds of the Passumpsic River Basin along with four watersheds that have identified water quality issues related to agricultural runoff. The bar chart shows the current number of large, medium, certified small and small farms by watershed as of the writing of this plan and the acreage of annual cropland and permanent hay/pasture in 2018 for each HUC 12 watershed (National Agricultural Statistics Service).

Agricultural Regulatory Programs

The VAAFMs RAPs, formerly the Accepted Agricultural Practices, and existing MFO and LFO permit programs set baseline farm management practices to ensure environmental stewardship. Medium and Large Farm Operational Permits have been in place for over 10 years. The RAPs were revised in 2016 and 2018 to support the necessary phosphorus load reductions for the Lake Champlain and Lake Memphremagog TMDLs and nitrogen reductions for the LIS TMDL. Details on the RAPs and recent changes can be found at this link. These revisions are expected to result in a significant increase in conservation practice implementation in the future. A few examples of the revisions to the RAPs include new requirements for nutrient management planning and implementation, increased perennially vegetative buffer zones and manure spreading setbacks, reduction in maximum soil erosion rates. The Flood Hazard Area and River Corridor Rule, effective in 2015, also regulates agricultural practices (as well as state facilities, silvicultural practices, and public energy transmission projects). The Rule limits new encroachments that could reduce floodplain storage and/or contribute to stream channel instability.

Large (LFO) and Medium (MFO) Farm Operation Programs

The VAAFM LFO Program requires large sized farms with more than 700 dairy cows (or the equivalent in other species) to operate under an individual permit. The VAAFM MFO Program requires farms with between 200 and 700 cows (or equivalent) to operate under a general permit. Both permit program requirements exceed those of the technical components of the Federal Clean Water Act and aim to reduce the amount of phosphorus and other nutrients entering Vermont's waterways.

Adaptations:

A small family farm in Sutton embrace new practices

Kyle and his uncle James Seymour at their family farm in Sutton, VT

After the Required Agricultural Practices were passed, Kyle was approached about developing a Nutrient Management Plan (NMP) for their family farm. After studying Dairy Management in college, he was interested in writing the plan himself. He worked with their local Conservation District to collect soil samples and field information to prepare for taking UVM Extension's "Digging In" class to write their own NMP. During the process, he learned their farm fields had a high risk of soil loss and were prone to leaching nitrogen, a potential problem for water quality and a concern for the farm in optimizing their soil health and maintaining their much-needed nutrients for growing crops. As a result, they decided to try no-till practices and better target their nitrogen fertilizer applications. After two years the result include reduced fuel costs, fertilizer savings, reduce soil loss, and improved forage quality from comparable yields. Kyle has been keeping their NMP updated and continues to look for new innovations to try on their farm.

In the Passumpsic River Basin, there is only one individually permitted LFO and no farms seeking coverage under the MFO General Permit. VAAFM inspects all LFOs annually and all MFOs every three years. Inspections include assessments of farm Nutrient Management Plans (NMPs), production area assessments of all facilities associated with the permitted operation, and cropland management assessments in accordance with Vermont's Water Quality Standards, RAP's, and the farm's individual nutrient management plan.

Certified Small (CSFO) and Small Farm Operations (SFO) Programs

VAAFM's Certified Small Farm Operations (CSFO) program supports farmers to ensure their clear understanding of the RAPs, while helping assess, plan, and implement any necessary conservation and management practices necessary to meet water quality goals. VAAFM estimates that there are 17 CSFO in the Passumpsic River watershed – mostly in the Calendar Brook, Lower Moose River, Sleepers River, South Wheelock Branch, and Water Andric watersheds. CSFOs are required to annually self-certify their operations and will be inspected at least once every 7 years. Priority watersheds for inspection in this basin include the Water Andric and Chesterfield Valley Brook watersheds. The Certified Small Farm Program began July 1, 2017. Since this program is still new many small farms have not yet been inspected, and so much of the effort at this stage is increased education and outreach about regulations and financial and technical assistance programs.

The VAAFM estimates 22 small farms in the Passumpsic River Basin will fall within RAP jurisdiction but may not need to certify. Figure 11 shows the distribution of farms by size in each HUC 12 watershed. Outreach will need to continue to the remaining farms or locations to help landowners understand where they fall within the RAP farm size categories and to help them understand the RAP requirements.

Agricultural Assistance and Outreach Programs

In addition to work completed to meet regulatory requirements, farm operators have begun and will continue to voluntarily adopt BMPs based on the increased availability of technical and financial assistance throughout the Passumpsic River Basin. VAAFM and NRCS both fund several programs that support farmers with developing nutrient management plans, implementing practices, or purchasing equipment to improve water quality. State funding programs are listed on the VAAFM website at https://agriculture.vermont.gov/grants. Figure 12 represents the combination of conservation practices implemented from 2012 to 2018 through state and federal assistance programs. Figure 12 shows an increase in the acreage of crop rotation, cover cropping corn/hay conversion and conservation tillage practices over time. There has also been an increase in the number of waste storage facilities and barnyard management practices from 2012 through 2018 primarily focused in the Calendar Brook watershed and to a lesser degree in the Sleepers River and Water Andric watersheds. This graph just represents practices funded though these programs so practices that continued by the farmer outside these programs would not be included.

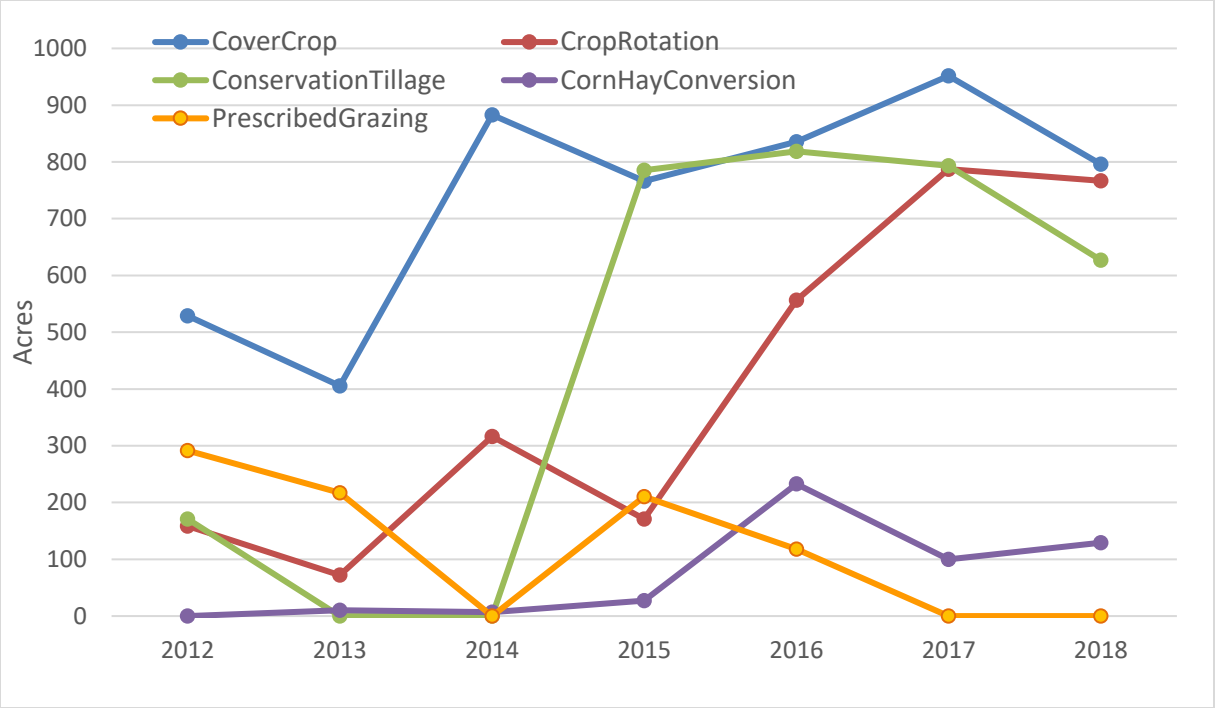


Figure 12. Acreage of NRCS and VAAFM practices implemented by year in the Passumpsic River Basin

While some farmstead work has focused in the Chesterfield valley and Water Andric watersheds – additional work in these areas may be necessary to address *E. coli* and nutrient sources respectively. There are two small farms in the Joes Brook HUC 12 watershed that includes Joes Pond and so if there are above Joes Pond these would be a priority for farmstead projects. The focus for the Millers Run watershed is on river channel conditions for which farmstead BMPs would not be a focus.

Figure 13 shows that a large percentage of land in annual cropland was addressed by field BMPs in 2018. Many of the HUC 12 watersheds showing more acreage of field BMPs than acreage of annual cropland, which indicates that many of these field BMPs are overlapping as each BMP is counted separately. For example, ten acres of conservation tillage and ten acres of cover crop implemented on the *same* field (overlap) are counted as 20 acres of field BMPs. VAAFM is pilot testing a partner database and coordinating with NRCS to create a method for identifying overlap and duplicative BMPs. Millers Run watershed was the exception, where a relatively small percentage of annual cropland had field BMPs installed in 2018 through state or federal funding. Since this watershed is a focus for this plan due to stream instability, implementing field BMPs in this watershed is a priority for this tactical basin planning cycle with a focus on riparian restoration and river corridor protection.

EXPLANATION OF FIGURE 13

This chart and map show the level of BMP implementation in each HUC 12 watershed relative the area of annual cropland where these practices can be applied. Three of the watersheds identified as impacted by agriculture have high levels of BMP implementation although there is still room for additional practice instillation where BMPs could help to improve water quality further. On the other hand, the fourth target watershed, Millers Run, does not have a high percentage of lands with BMPs funded though VAAFM or NRCS which makes this a target for BMP implementation going forward.

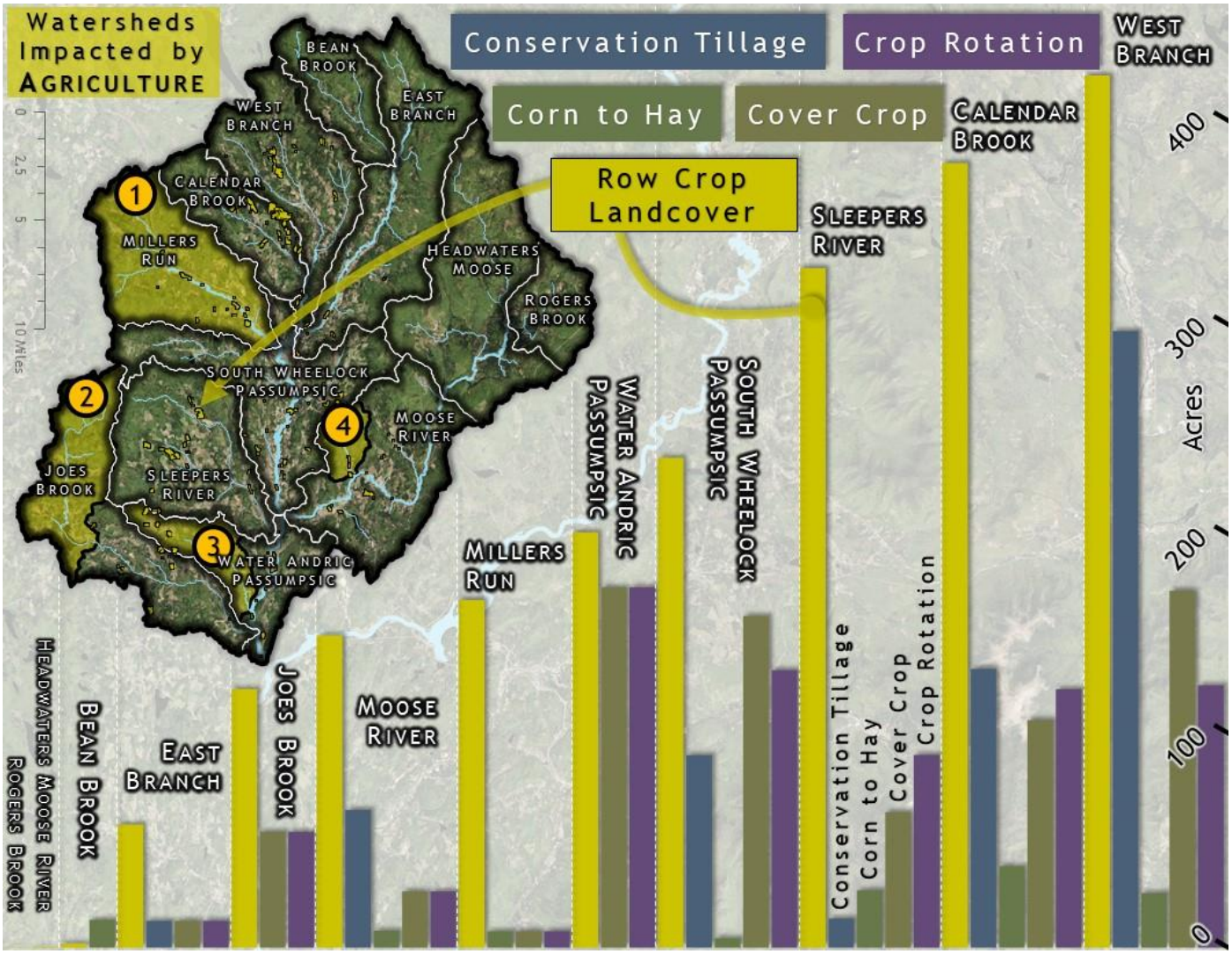


Figure 13. Acres of VAAFM and NRCS field practices implemented by HUC 12 watershed in 2018 – along with 2018 annual cropland acreage based on NASS croplands dataset.

Tactical Basin Plan Implementation for Agriculture

A workgroup for the Passumpsic and Upper Connecticut River Basins was established in 2018 to coordinate agricultural water quality improvement efforts. Members of this workgroup include UVM Extension., local Conservation Districts, USDA Natural Resources Service, DEC Basin Planner, and VAAFM staff that work with small, medium and large farms. This group has met twice to discuss agricultural priorities in the watershed and sustaining this group is an important strategy in this plan to effectively target agricultural BMP implementation to improve water quality conditions. Other strategies that are a focus for this group are listed below and in the implementation table:

- Hosting annual workshops on improving soil health, RAP revisions and the Flood Hazard & River Corridor Rule, implementing conservation tillage and cover cropping practices.
- Supporting farmers in developing Nutrient Management Plans (NMPs) and continuing to work with priority farms on implementing NMPs
- Developing a regional equipment sharing programs to support the implementation of effective cover cropping and reduced tillage practices.
- Conducting outreach to better promote buffer planting programs across the watershed.
- Developing a water quality monitoring and research effort to understand nitrogen source areas in the Passumpsic and Upper Connecticut River watersheds.
- Identifying areas for potential voluntary land use changes that would provide increase water quality protection as well as financial support to the farmers.
- Coordinating outreach and targeting project implementation among partners

Click the following hyperlink to view strategies to address Runoff from Agricultural Lands.

B. Developed Lands -- Stormwater

Stormwater runoff is a contributor to many of the water quality issues in the Passumpsic River Basin. Impairments in the basin are caused by Combined Sewer Overflows (CSOs) driven by stormwater runoff into the St. Johnsbury combined waste and stormwater systems which results in the release of untreated waste and stormwater when the system can't handle the flow volumes. These overflows cause the *E. coli* impairment of the Passumpsic and Sleepers Rivers. Stormwater runoff across the basin also contributes nitrogen which is a concern in relation to Long Island Sound with the primary source areas being in St. Johnsbury, Lyndon and other small communities such as Concord. Stormwater runoff is a key concern in Dish Mill Brook, draining developed areas near Burke Mountain which has been noted as causing erosion and a resulting high sand bedload. Stormwater runoff may also be a contributor to elevated levels of sediment and nutrients along the Water Andric and nitrogen regarding the LIS TMDL. Finally, stormwater runoff from developed lands is a contributor to nutrient loading to many upland lakes where we see impacts from encroachment on the littoral zone and nutrient and sediment loading including Joes Pond, Stiles Pond, Center Pond.

This section integrates basin-specific information on stormwater-related water resource impairments, regulatory programs, stormwater master plans, Illicit Discharge Detection and Elimination (IDDE) studies, existing implementation efforts and partnerships to inform strategies to address stormwater-related water resource impairments. The tactical basin planning approach engages local, regional, and federal partners in the development of strategies needed to accelerate adoption and monitoring of stormwater-related BMPs to meet the state's clean water goals including reductions to support the Long Island Nitrogen TMDL. The section is organized around the 3-acre operational permit, stormwater master planning and IDDE studies which are the primary drivers for voluntary implementation efforts in the Basin.

Operational three-acre impervious surface permit program

The Stormwater Program will issue a general permit in 2019 for stormwater from so-called "three-acre sites" which are existing sites with three or more acres of impervious surface that lack a stormwater permit based on the 2002 Vermont Stormwater Management Manual. For the Connecticut River watershed including the Passumpsic River Basin, parcels will need to apply for permit coverage by 2033. Since this date is well beyond the timeframe for this plan, voluntary stormwater efforts though stormwater master planning are likely to be the primary drivers for stormwater implementation efforts for this planning cycle.

Stormwater Master Planning and Outreach

Stormwater master plans (SWMP) have been completed or are in the works for most of the communities with stormwater systems in the Passumpsic River Basin as well as the Dish Mill Brook watershed where development around Burke Mountain Resort has caused increased sedimentation and stormwater runoff. The Caledonia and Essex County Conservation Districts have taken the lead on these assessments in this basin working closely with local communities. In addition, the NorthWoods Stewardship Center (NWSC) has been partnering with the Conservation Districts to provide a summer Work Crew to implement small scale stormwater practices. Below are brief updates on the stormwater master planning efforts in each of these communities.

St. Johnsbury

The Stormwater Master Plan (SWMP) for the town of St. Johnsbury was completed in 2016 and assessed approximately 1800 acres of drainage primarily centered on the village area of St. Johnsbury and extending north forming a corridor to St. Johnsbury Center. The SWMP outlined 25 stormwater "problem areas", nine of which were prioritized and advanced to a greater level of detail and design. One project that was identified in the plan was a sand pile noted on Bay Street that was eroding into the Passumpsic River which did not require further design and was removed after outreach to the town. Prior to the SWMP, a stormwater treatment project was installed along Western Ave, treating 95-acres of drainage with 41-acres of impervious surface. Additional completed projects are listed on the right. Next steps include:

Stormwater water quality accomplishments over the last 5 years…

- ✓ **Completion of the St. Johnsbury SWMP and installation of:**
  - Oak Street neighborhood scale infiltration practices
  - Town Garage sedimentation basin
  - Bay Street Sand Pile removal
  - Pearl Street parking lot design
- ✓ **Completion of the Lyndon SWMP and installation of:**
  - Fenton Chester Arena treatment practices
  - Rain garden and infiltration trench, and trail erosion control at Lyndon Institute
  - Rain gardens and erosion control at Northern Vermont University
  - Designs are being developed for several large-scale practices
- ✓ **Completion of the Dish Mill Brook SWMP and installation of:**
  - Several rain gardens at Burke Mountain Resort
  - Instillation of an infiltration basin at Burke Mountain Academy.
  - Several designs for large scale stormwater at the base and Mid Burke Lodge
- ✓ **Completion of a SWMP for the Town of Concord**

Fenton Chester Arena treatment practice

- The retrofit of the Pearl Street municipal parking lot to improve drainage and install green stormwater infrastructure (GSI) practices.
- Continued partnership with the Town of St. Johnsbury to integrate GSI into CSO construction projects to achieve co-benefits and install GSI practices in CSO watersheds to reduce stormwater flows where CSO efforts may not take place for many years
- Continued outreach to St. Johnsbury Academy to address erosion concerns and pursue opportunities for improved stormwater management and GSI integration on campus.

Lyndon

The Town of Lyndon Stormwater Master Plan (SWMP) was completed in 2017 and evaluated 3300 acres of drainage area within the Village of Lyndonville, Lyndon State College (now called Northern Vermont University), and south of Lyndonville toward the industrial park. A total of 72 stormwater "problem areas" were identified and prioritized, including opportunities for Best Management Practice (BMP) installation, erosion control, and gully prevention and stabilization. Thirty (30) projects were selected for further development and design. A number of projects have been installed since the SWMP was completed, including small-scale design-build projects installed by NWSC at Lyndon Institute and Northern Vermont University, and stormwater drainage improvements and erosion control at the Fenton Chester Ice Arena. Project designs are underway for three additional projects in Lyndonville, and there are many more opportunities for project development, including:

- Installation of stormwater improvements for the "High Street" project, receiving drainage from Chase Street, a portion of High Street and the southern end of Pinehurst Street.
- Technical Assistance and alternatives analysis to Lyndonville and landowners regarding a large gully located at the end of South Prospect Street in Lyndonville.
- Continued project development and technical assistance to Northern Vermont University, including installation of gravel wetland near the Faculty Parking Lot, and Best Management Practice (BMP) installation at soccer field and near Dragon Pond.
- Assistance to Town of Lyndon to address drainage and gully erosion at Chamberlain Bridge.
- Continued installation of small design-build practices at Lyndon Institute and Northern Vermont University.

Dish Mill Brook

The Dish Mill Brook Stormwater Master Plan was completed in 2015 and included an assessment of developed lands within the 6.7-square mile or 4300-acre watershed. Three large projects were identified and developed at Burke Mountain, two smaller projects at Burke Mountain Academy, and one project in East Burke Village on Belden Hill. One project was installed at Burke Mountain Academy in 2018. Next steps include:

- Continuing to partner with Burke Mountain Resort to install large-scale stormwater projects designed for their base lodge and mid-Burke parking lots.
- Seeking funding to address gully erosion near Bear Path Development
- Maintaining communications with Burke Mountain Academy to encourage installation of project near Shelly Glover Center.
- Continued communications with Town of Burke to discuss road management and maintenance capacity for Belden Hill project.

Concord

The Concord Stormwater Master Plan was completed in Spring of 2019 and provided an assessment on WQ issues identified in the surrounding town properties. Twenty stormwater management opportunities were identified but two larger projects on Folsum Avenue and High Street were identified for implementation. Final project design for the Folsum Avenue project is planned for Summer of 2019 with partial project construction in the fall. Next steps include:

- Identification of funding sources for implementation of Folsum Avenue project.
- Coordination of activities with adjacent landowners and VTRANS.
- Seeking funding through various grants to address smaller project areas identified in SWMP including the High Street project.
- Provide Technical Assistance to ensure town residents understand project goals.
- Collaborate with Concord School to install small scale retro-fit opportunities.

Basin-wide Illicit Discharge Detection and Elimination (IDDE) Study

In 2015, Stone Environmental, Inc., completed an IDDE study of the Town of St. Johnsbury. The study is available on the web at:
http://dec.vermont.gov/sites/dec/files/wsm/erp/docs/IDDE/St%20J%20IDDE%20Final%20Report%20compiled.pdf

A second study was completed for the remaining stormwater systems in the basin in 2017 covering communities of Burke, Danville, Lyndon and Concord in the Passumpsic River Basin. This report is available at the following link:
http://dec.vermont.gov/sites/dec/files/wsm/erp/docs/IDDE/Upper-Mid-CT%20River%20IDDE_Vfinal_red.pdf

Through these studies stormwater drainage systems have been mapped and several discharges were detected and eliminated in the communities of Concord and St. Johnsbury although there are a few locations were some additional follow up is needed. Click the following hyperlink to view strategies to address Runoff from Developed Lands -- Stormwater.

C. Developed Lands -- Roads

Reducing road runoff and erosion is critical to meeting the state's clean water goals. Runoff from municipal roads is a major source of sediment and nutrients in the Passumpsic River Basin that contributes to water quality issues in the Dish Mill Brook, Water Andric, and Millers Run, Joes Pond, Center Pond and Stiles Pond watersheds (see Chapter 3). Road runoff also contributes a small portion of the nitrogen loading to the Connecticut River watershed which is a concern for the Long Island Sound Nitrogen TMDL.

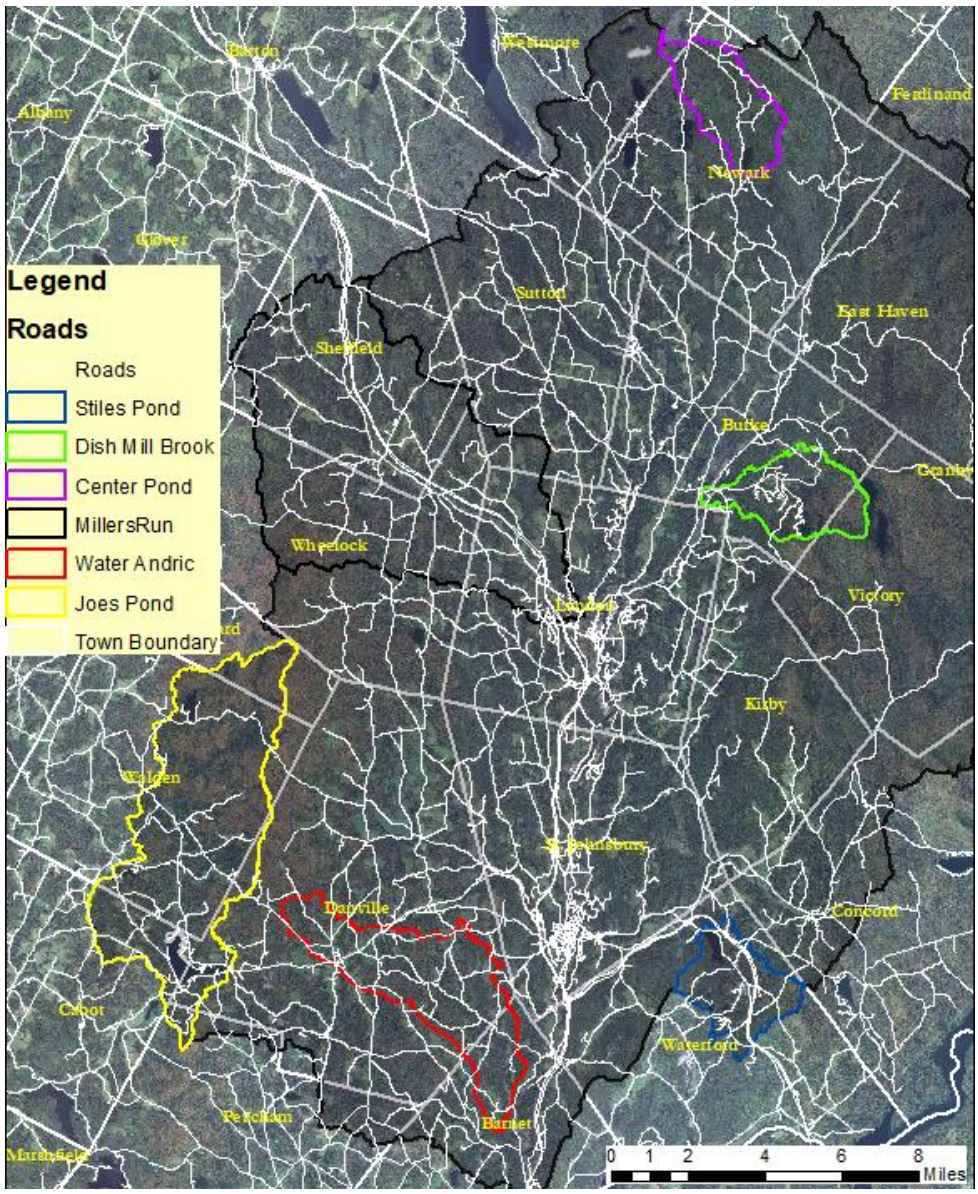


Figure 14. Target watersheds for implementation of road erosion practices

This section integrates basin-specific information on transportation-related water resource impairments, regulatory programs, road erosion inventories (REIs), road practice implementation, and existing partnerships to inform strategies to address water resource impairments. The tactical basin planning approach engages local, regional, state and federal partners in the development of strategies needed to accelerate transportation-related BMPs in order to meet the state's clean water goals including reductions to support the Long Island Sound nitrogen TMDL. The section is organized around the regulatory programs including the Municipal Roads

General Permit (MRGP), and the Transportation Separate Storm Sewer System Permit (TS4) as these regulatory programs are the driving factor in road water quality implementation efforts in the Basin.

Municipal Roads General Permit

The 2015 MRGP is a stormwater permit for Vermont cities and towns signed into law as part of Act 64. The MRGP is intended to achieve significant reductions in stormwater-related erosion from paved and unpaved roads. The permit requires each municipality to conduct a road erosion inventory (REI) of hydrologically connected roads by 12/31/2020 to determine if they meet MRGP standards (Figure 15). Hydrologically connected roads are those municipal roads within 100' of or that bisect a wetland, lake, pond, perennial or intermittent stream, or a municipal road that drains to one of these water resources. These road segments represent ≈ 60% of municipal roads and can be viewed using the "Municipal Road Theme" on the ANR Natural Resource Atlas. Road segments are assessed as ***fully meeting, partially meeting***, or ***not meeting*** the MRGP standards.

MRGP standards include: road crowning, stabilizing drainage ditches and turnouts, and upgrading drainage culverts and intermittent stream culverts. VDEC has established a timeline with milestones to guide towns through the MRGP requirements (Figure 15). Towns will use the REI results to prioritize road upgrades with goal of all municipal roads meeting the MRGP standard by 12/31/2036.

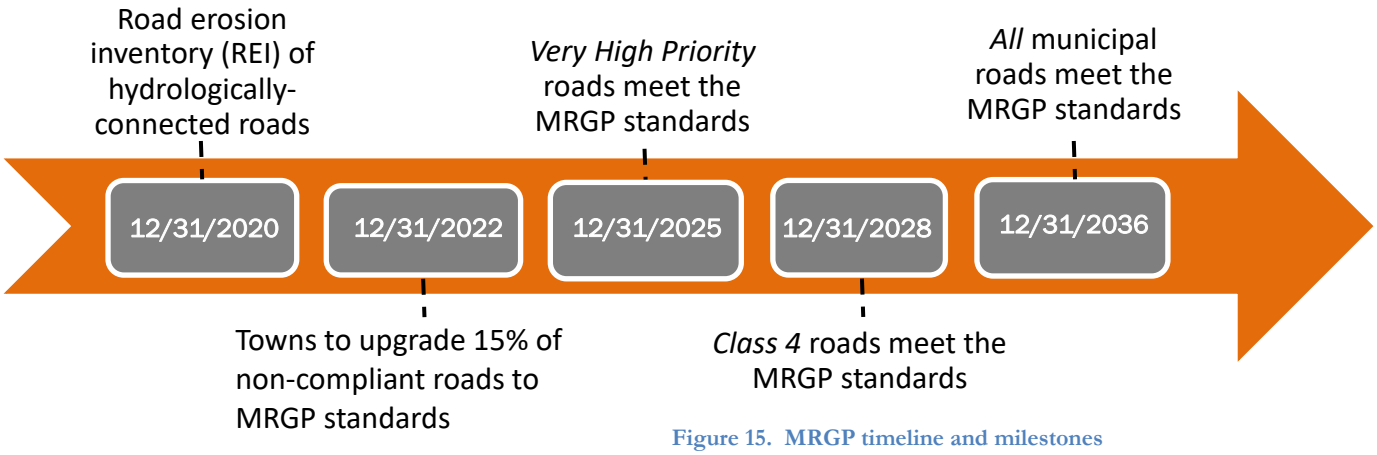


Figure 15. MRGP timeline and milestones

This plan recommends that technical and financial assistance be prioritized for interested towns based on the water quality benefit and feasibility of a project. Projects that "do not meet standards" and have >10% slope and high erosion risk are very high water quality priorities (Table 6). Resources available from the Clean Water Fund (e.g. VDEC Grant-in-Aid and VTrans Better Roads grants) assist with development of designs, capital budgets, cost estimates and implementation of road projects. Completion of these projects may be counted towards meeting the requirements of the MRGP. For additional information see the VDEC Municipal Roads Program.

Table 8. Prioritization of municipal road segments based on REI status and slope. Road segments that do not meet standards and are on a steep slope are priorities for water quality protection

MRGP Status	0-4% slope or Low Road Erosion Risk	5-9% slope or Moderate Road Erosion Risk	10%+ slope or High Road Erosion Risk
Fully Meets	-	-	-
Partially Meets	Low priority	Moderate priority	Moderate priority
Does Not Meet	Moderate priority	High priority	Very High priority

DEC and its partners are offering training, technical assistance, outreach, and funding for REIs, road upgrades and equipment purchases to assist municipalities with the MRGP requirements. For towns in Caledonia, Orleans and Essex Counties, a Northeast Kingdom Roads and Rivers workgroup (NEKRR) was established to support towns in these efforts. This group includes: VTrans, NVDA, Natural Resources Conservation Districts, NWSC, Memphremagog Watershed Association, and VDEC. This workgroup provides municipalities with outreach, technical and financial assistance, and additional training to assist towns with the upcoming MRGP requirements.

NVDA set up a partnership with Northern Vermont University to support the completion of REIs necessary to meet MRGP requirements, while partners in the NEKRR workgroup continue to work with towns on the development of more complete capital budgets to support towns in applying for better road grants. Table 9 below shows the status for REIs for each town in the basin. Table 10

Table 9. Progress of Passumpsic River Basin towns toward completing Road Erosion Inventories

REI Status	Complete	Complete (need to be uploaded)	Planned (2019-2020)
Towns	Danville, Lyndon Sheffield, Sutton, Waterford	Barnet, Kirby, Peacham, Stannard, Walden, Granby	Burke, Newark, St. Johnsbury, Wheelock Concord, East Haven, Victory, Westmore

shows the preliminary number of segments that meet standards For road segments that don't meet standards or partially meet standards Table 10 identifies the priority for addressing segments following the prioritization scheme shown in Table 8. Many towns that completed earlier inventories still need to have assessments uploaded into the MRGP database and eight towns still need to complete inventories by 2020.

Table 10. Count of 100m road segments in the Passumpsic River Basin broken down by town based on REI status as of 3/27/19

Municipality	Hydrologically Connected	No Data	Incomplete Data	Very High	High	Moderate	Low	Meets Standards
Barnet	274	274						
Burke	419	419						
Cabot	40	40						
Concord	257	257						
Danville	700	10	1	31	29	44	26	559
East Haven	156	156						
Granby	94	94						
Kirby	255	255						
Lyndon	602	17	1	37	32	24	9	482
Lyndonville Village	91	91						
Newark	223	222						1
Peacham	37	37						
Saint Johnsbury	772	770			1			1
Sheffield	189	4	1	16	12	7	2	147
Sutton	238	6		15	11	8	3	195
Victory	199	199						
Walden	107	107						
Waterford	222	153	1	1	1	3	1	62
West Burke Village	31	31						
Westmore	15	15						
Wheelock	216	216						
Total	**5137**	**3373**	**4**	**100**	**86**	**86**	**41**	**1447**

Funding through tactical basin planning grants and the Transportation Planning Initiative provide support that allows NVDA and Conservation Districts to continue to work with towns after inventories have been completed to apply for Vtrans Better Road grants and other funding sources to implement the capital budgets. This funding, and the partnerships it supports have been instrumental in getting REIs completed for towns in this basin as many towns have small road crews and limited town staff and so Strategy 15 is to continue this support so that the eight towns that need REIs can get them completed before the deadline of December 31st, 2020. Towns also need technical support to be able to use technology including tablets with software to track road segment status. Strategy 16 is to provide towns with workshops and one on one assistance on how to use these systems. Six towns in the basin completed REIs before the current software application was available. Strategy 17 is to support towns in getting these data uploaded into the MRGP database. In addition, many towns need technical assistance in developing project proposals and budgets and in seeking funding to implement high priority projects that have the largest water quality benefits as

highlighted in strategy 18. Strategy 19 supports the completion of very high and high priority projects in target watersheds as well as other water quality priority projects in the basin.

Another local effort has involved working with NWSC watershed work crew to address erosion issues on class 4 roads and legal trails which are often a lower priority for municipal officials but are frequently large sources of sediment. Continuing this work is important as more towns complete assessments and identify areas where a work crew can be effective at addressing WQ issues (Strategy 20).

There are also limitations on equipment that make it challenging for towns to meet towns MRGP standards. Some of the equipment most needed to support this work in the basin include hydro seeders, hay bale shredders, leaf blowers and shoulder discs. In addition to purchasing equipment, municipalities need support in how to use this equipment most effectively and how to implement best management practices. Peer-to-peer information sharing is needed, including information on best management practices for fertilizer use in hydro seeders and hosting workshops on best management practices for this equipment (strategy 21).

Click the following hyperlink to view summary strategies to address Runoff from Municipal Roads.

D. Wastewater

In the Passumpsic River Basin, there are three municipal wastewater treatment facilities and one electrical paper manufacturing facility. All of these are subject to NPDES discharge permit requirements issued by the State of Vermont (Table 11).

An overarching consideration for the issuance of permits in the Passumpsic planning basin is the Long Island Sound TMDL for nitrogen. This multi-state TMDL has been promulgated with interim waste load and nonpoint source nitrogen load allocations. As of the issuance of this Plan, all facilities are operating under permits developed under a nitrogen permitting strategy whereby all Vermont WWTFs ultimately discharging to the Connecticut River must, collectively, discharge no more than 1,727 lbs. TN/day. Each individual facility has a unique TN loading limit. In addition to the nitrogen loading limit, WWTFs are required to develop optimization plans for maximizing nitrogen removal and regularly monitor for nitrogen compounds.

As part of an effort to be better informed about potential nutrient impacts, the WSMD, with assistance from certain municipalities, is conducting an extensive sampling effort to document the current loading conditions to determine the "reasonable potential" that WWTFs have, to cause or contribute to downstream water quality impairment. Results of these investigations are recorded as part of permit issuance documentation. The municipal wastewater discharge permits in the Basin are shown in Table 11.

Facility Specific Information

Table 11. WWTF permit details for facilities in the Passumpsic River Basin

Facility (permit ID)	Permit effective date	Planned permit re-issuance year	Design flow (MGD)	IWC* 7Q10 /LMM	Current Percent of Design Flow (2017)	Treatment type	# of CSOs	Receiving water
Danville	2018 amended	2021	0.060	0.146 / 0.076	66%	Aerated lagoon	0	Water Andric
Lyndon	2016	2021	0.75	0.029 / 0.010	19%	Activated sludge	0	Passumpsic River
St. Johnsbury	2018	2023	1.6	0.028 / 0.011	50%	Rotating biological contactor	15	Passumpsic River
EHV Weidman	2012	2019	0.350	0.011 / 0.004	41%		0	Passumpsic River

** Instream Waste Concentration – or the proportion of river flow at lowest base (7Q10) and low median monthly (LMM) flow attributable to discharge, for the facility design flow. Note that the IWC is specific to the flow of receiving water.*

Danville

The Danville WWTF is a small facility discharging to a receiving stream of limited assimilative capacity. A waste management zone extends from the outfall one-mile downstream. Owing to the small size of the receiving water, this facility is required to monitor receiving water flow during summer months, and release effluent only in such quantities as can be assimilated, based on measured effluent concentrations for key pollutants.

Lyndon

The Lyndon WWTF was upgraded in 2012 from extended aeration to complete mix activated sludge with anoxic selectors. The upgrade included new mechanical fine-screens, grit removal, and centrifugation to de-water sludges, to improve operational and cost efficiency. The facility participated in the Long Island Sound TMDL nitrogen treatment optimization study. As noted in this study the plant staff at Lyndonville have been experimenting with cyclic aeration to reduce nitrogen without having to use a recycle pump and this approach has shown good nitrogen removal over extended periods, except for colder temperatures (JJ Environmental, 2015).

St. Johnsbury

The St. Johnsbury facility is actively pursuing remediation of CSO outfall points as required by order of the Department, under authority of 10 V.S.A.§1272. The municipality is developing a long term control plan to develop and select the long-term CSO controls. Through this process St. Johnsbury is encouraged to evaluate and implement GSI for stormwater runoff and sewer overflow management to the greatest extent possible as described in more detail in the stormwater sector section of this plan. Several outfall points are identified by this Order, which are being remediated in sequence by the City. During 2018, the City replaced a 600-foot section of 6-inch diameter force main crossing the Passumpsic River and extending to Oak Street to increase capacity of the Hood Pump Station. Replacement of the Oak Street pump station is currently under contract for construction and is scheduled to be completed by 2019. An $8.7 million-dollar combined sewer separation project for the Pleasant Street, Gilman Avenue, and Farmer Drive area was approved at the 2019 Town Meeting.

The St. Johnsbury wastewater treatment facility has completed numerous upgrades over the past couple of years. In 2015, the facility installed a magnetic flow meter for septage metering and upgraded the chemical feed system. In 2016, the two Archimedes-style screw pumps that carry influent wastewater into the facility's headworks were replaced. In 2017, a new headworks building with a new grinder, fine screen, and compactor was installed. In 2018, refurbishment of the digester mixing system and repair of the digester exterior walls was completed. In 2019, the facility plans on installing an influent flow meter, methane/oil furnace, and a methane waste burner.

E. Natural Resource Restoration--Forests

Forest lands cover a majority of the Passumpsic River watershed and maintaining forestland cover is a key strategy to maintaining water quality conditions in the Passumpsic River Basin. Poorly planned and implemented forestry operations can be a source of sediment and nutrients which can impact surface waters. Logging operations have not been specifically identified as a cause for any of the stressed or impaired waters in the basin however poor logging practices may contribute to nutrient loading which is a concern for several waters. This section includes information around the forestland conservation efforts, the Acceptable Management Practices for Logging Jobs, Vermont Voluntary Harvesting Guidelines to protect forest health and Sustainability, local skidder bridge programs.

The focus for this tactical basin plan is to support the working forest lands across the basin to maintain forest lands for water quality as well as many other benefits. This will be done by supporting VDFPR, VFWD, local land trusts and conservation organizations in conserving forest blocks that are important for maintaining good water quality along with wildlife and other functions. As described in Chapter 1 the LISW-RCPP has a focus on protection of non-industrial forest habitat, diversity and drinking water sources.

Vermont adopted rules in 1987 for Acceptable Management Practices (AMPs) for Maintaining Water Quality on Logging Jobs in Vermont and updated these effective August 11, 2018. The AMPs are intended and designed to prevent any sediment, petroleum products and woody debris (logging slash) from entering the waters of the State and to otherwise minimize the risks to water quality. The state also published a set of voluntary harvesting guidelines in 2015 which include a chapter on protecting water resources which go above the AMPs. One strategy in the plan is to support outreach to private forestland owners, foresters and loggers on the revised AMPs and voluntary harvesting guidelines. VDFPR can be reached directly for technical assistance for harvesting and associated stream crossings.

The Department of Forests, Parks and Recreation is promoting and demonstrating the use of portable bridge designs on timber harvesting operations throughout Vermont, including a bridge that is rented through the Caledonia County Natural Resources Conservation District in this basin. When properly installed, used, and removed, skidder bridges minimize stream bank and stream bed disturbance as compared with alternative devices, such as culverts or poled fords. In addition, these bridges reduce the occurrence of sedimentation, channeling, and any degradation of aquatic habitat, while allowing loggers to harvest timber in compliance with the AMPs. Continued support for this program and outreach necessary to maximize the use of the bridges will support water quality improvements in the basin and support loggers in meeting the new AMP's.

Click the following hyperlink to view summary strategies to address Runoff from Forest Lands.

F. Natural Resource Restoration--Lakeshore Restoration

Restoration of lakeshores is critical to meeting the state's clean water goals in the Passumpsic River Basin. Several lakes in the Basin have increasing phosphorus trends or fair or poor shoreland conditions with Joes Pond having both. Joes Pond is rated as having poor shoreland conditions while Bald Hill, Stiles, Bean, Chandler, Coles, Duck and Newark ponds are rated as having fair shoreland conditions.

This section includes basin specific information about the Lake Wise program which is the State's focus for restoring lakeshore habitat. Tactical basin planning can play an integral role in supporting Lake Wise assessments by engaging local communities, lake and watershed organizations and partners in the targeting of these efforts locally where to date there hasn't been a lot of local support. This section provides a brief update on the shoreland protection act and then a discussion of how efforts can target lake wise restoration efforts to restore lakeshore conditions in this basin.

Shoreland protection act

The Shoreland Protection Act ensures that new shoreland development will have minimal impact on the lake in terms of phosphorus and sediment runoff, and degradation of aquatic habitat. This program regulates shoreland development within 250 feet of a lake's mean water level for all lakes greater than 10 acres in size.

Lake Wise Program

Many of the lakes in the basin already have high levels of development along their shorelands and efforts are needed to restore shoreland conditions. To address this issue, VDEC's Lakes and Ponds Management and Protection Program created the Lake Wise program that is designed to provide outreach and technical assistance around shoreland management. Launched in the summer of 2013, the program provides on-site review of shoreland conditions and recommendations for lessening the impact of existing shoreland development on a lake. More importantly, the program is designed to recognize and reward good shoreland management by providing landowners with an attractive sign to post on their property that indicates they are "Lake Wise." Landowners wishing to retrofit their property to meet Lake Wise standards are given a list of BMPs that can be easily implemented. Participation is tracked and a cumulative benefit of the program in terms of improved property management can be calculated. There have been no Lake Wise assessments in the Passumpsic River Basin to date. The status of Lake Wise assessments in the basin can be viewed online at :http://dec.vermont.gov/watershed/lakes-ponds/lakeshores-lake-wise/lakewisemap

The Agency is developing a Lake Wise planning process where coordinated Lake Wise assessments can be done around a target lake with each assessment cataloging potential BMP projects and landowner interest in implementing these. These BMPs will then be prioritized based on their ability to reduce nutrient runoff and improve habitat conditions along lakes and landowner interest in

implementing practices. Joes Pond and Center Pond are priorities for Lake Wise planning if the local landowners or lake association support these efforts and Bald Hill, Bean, Coles, Duck and Newark ponds may also benefit from such an effort.

The Passumpsic River Basin is unique in Vermont in that no lakes have identified aquatic invasive species and so support for AIS spread prevention efforts is a strategy in this plan.

Click the following hyperlink to view summary strategies to address Runoff from Lakeshore Properties.

G. Natural Resource Restoration--River Connectivity

Rivers are in a constant balancing act between the energy they produce and the work that must be done to carry the water, ice, sediment and woody material produced in their watersheds. A change in any one of these factors will cause adjustments of the other variables until the river system comes back into equilibrium (balance). These changes can be caused by natural events and by human activity. Human activities can disrupt the balance by changing flow inputs to the channel (such as by deforestation, increasing impervious surfaces and runoff, or water withdrawals) or by changing sediment regime (such as with dams, dredging, or in response to intensified erosion). In this basin, channel alterations such as straightening, dredging, berm construction, and gravel mining have played a significant role in the stream instability we see today. Over time, channel alterations have caused the streambed to degrade (erode downward) in many areas, preventing streams from being able to regularly flow onto their floodplains, lose energy, and deposit sediment, ice, and wood. As a result, floods become more powerful and erosive in many areas, as high flows are more confined in the stream channel and can't spread out or slow down until they reach a place to break out. Sediment and floodwater that would have otherwise been deposited or stored along the way is transported downstream, leading to higher flood levels and channel migration downstream. . The impact of these actions may be seen immediately, at the degraded site or downstream, or for decades after the activity occurred. We are still seeing the impacts in this basin of activities from decades before including:

- Historic deforestation and land clearing
- Roads, railroads, and other development
- Widespread dredging and gravel mining on the East Branch of the Passumpsic River and Calendar Brook,
- Interstate 91 construction in the Millers Run watershed, which increased flow inputs to this watershed

The goal of managing toward protecting and restoring the equilibrium condition of Vermont rivers is to resolve or avoid conflicts between human investments and river dynamics in a manner that is technically sound, and economically, socially and ecologically sustainable. While water quality in the Passumpsic River Basin is some of the best in the state, the degraded geomorphic condition of some of the basin's streams impacts wildlife and fish habitat (e.g. riparian buffer removal that reduces shading and habitat for insects that feed fish, and channel alteration that destroys aquatic habitat), public safety (e.g. loss of floodplains that store floodwaters, accelerated streambank erosion which

results in infrastructure damage, and channel straightening that increases flow velocity during rain events), soil building, and water quality (e.g. higher *E. coli* populations caused by increased fine sediment resuspension and bank soil erosion, and nutrient and chemical runoff from encroachment of impervious surfaces and agricultural land). Managing towards stream equilibrium is essential for good water quality, healthy aquatic habitat, and flood resilience in the basin and will help to mitigate impacts of increased runoff and streamflow described in the Climate Change section.

This section includes basin specific information on how to improve river connectivity. River connectivity means that a river is connected longitudinally, laterally, vertically, and temporarily to support stream equilibrium and riparian habitat. In simple terms, a connected river is a river that freely flows from upstream to downstream, freely meanders and exchanges water with lands, vegetation, and waterbodies alongside its path, freely accesses its floodplain, and freely cycles through its flow pattern with the seasons. The tactical basin planning approach engages local, regional, and federal partners in the development of strategies needed to accelerate practices to increase river connectivity and meet the state's clean water goals including reductions to support the Long Island Nitrogen TMDL. This section provides an overview of stream geomorphic assessments completed in the basin, restoration project priorities, community efforts to regulate floodplain and river corridor development, and efforts to improve Aquatic Organism Passage (AOP) and riparian habitat.

Project Spotlight: East Branch Dam Removal

Before and after pictures of the East Burke Dam

The East Burke Dam was removed in the fall of 2017 through a collaborative effort between the Passumpsic Valley Land Trust, Connecticut River Conservancy and several other partners and funding sources. This project connected 99 miles of stream for aquatic organism passage, improved habitat, and restored natural sediment transport. The project involved the removal of 11,000 cubic yards of trapped sediment and included riparian buffer plantings. This tactical basin plan includes a recommendation to continue to monitor the geomorphic condition of the East Branch as it adjusts to a more natural sediment and hydrological regime which should continue to improve habitat up and downstream.

Stream Geomorphic Assessments & Restoration Project priorities

Phase 1 and Phase 2 stream geomorphic assessments have been completed on portions of all the major tributaries in the Passumpsic River Watershed except for Joes Brook which only has had a Phase 1 assessment. The Passumpsic River main stem has not been assessed since it is influenced by dams for most of its length except for the reaches from the East and West Branch confluence to the backwater of the Vail Dam where a Phase 2 assessment would be valuable. Assessments on Millers Run, the East and West Branch and the Moose River were done between 2006 and 2010 using earlier protocols and did not include funding for detailed project development work and where such work was completed land ownership may have since changed. More recent assessments of Dish Mill Brook and lower tributaries did involve more project development and a few of these projects were completed. All final assessment reports are available at the following link. Funding is needed to support continued project development work in all these areas as recommended by strategy 31.

Additional project development is especially needed to advance restoration of floodplain access and stream stability, through active projects such as floodplain excavation, berm removal, channel restoration, and/or river corridor easements where feasible. These projects will be key to restoring stream stability and water quality, especially in subwatersheds where sediment impairment is of concern. Opportunities will become feasible through outreach to find interested landowners and by building off riparian land ownership by the Passumpsic Valley Land Trust.

Through these stream geomorphic assessments and other assessments, several dams have been identified as priorities for removal in the watershed. Three of these were identified by the Village of Lyndonville as obsolete water supply reservoirs that are a liability for the village and also block aquatic organism and sediment movement. American Rivers coordinated a preliminary assessment of opportunities and constraints for the removal of these three dams plus a nearby privately-owned dam and is continuing to look for funding to move forward with removal efforts for the Fay Young Reservoir (Strategy 34). In addition to this, the stream geomorphic assessment of the Sleepers Rivers identified several USGS Weirs that are barriers to aquatic organism and sediment transport and no longer appear to be in use to gage stream flows in this study watershed. Strategy 35 recommends a discussion with USGS on the potential removal of Weirs in the Sleepers River watershed and restoration of aquatic habitat.

The Vermont Department of Fish and Wildlife has identified the East and West branches of the Moose River and Line Brook as priorities to restore Brook Trout habitat through strategic wood addition, as these streams were historically impacted by logging operations. Field assessments of these streams identified lower large woody material densities than desired for supporting Brook Trout communities. Similar work in the upper Connecticut River basin has shown increases in Brook Trout density through strategic wood addition and studies are being done to evaluate increased floodplain access and storage of sediment in instream gravel bars that can also be achieved through strategic wood addition in targeted locations. VFW has identified James Brook, Cold Brook, Weir Mill Brook, Umpire Brook and Bog Brook in the Moose River watershed, as well as Mathewson Brook, Calendar Brook, Steam Mill Brook, and Rock Brook that flow through state

lands as priorities for determining whether strategic wood addition may be appropriate on these streams which are all listed in the monitoring priorities table.

Bridge and Culvert Surveys

The CCNRCD and Vermont Fish and Wildlife Departments have completed VANR Bridge and Culvert assessments of most culverts in the Passumpsic River Basin. Undersized or poorly installed culverts can increase sediment loading and pose a risk to public health when they fail or act as a barrier to sediment movement, which causes erosion downstream of the structure. Culverts can also act as a barrier to aquatic organism passage (AOP) and this can have impacts as fish and other species need to move to gain access to colder water habitats, feeding and spawning locations, and for natural dispersal. The Vermont Agency of Natural Resources has developed a bridge and culvert assessment and screening tools that provide a first cut as to the need for replacement or retrofit to restore fish passage or address geomorphic issues and a guide for Implementing AOP Enhancement Projects in Vermont (Kirn, 2016). In addition to these, new visualization tools have been developed by the WSMD assessment program to view the outputs from these assessments such as the culvert mapping tool http://arcg.is/19eqSD0.

Floodplain and River Corridor Bylaws

Local zoning, bylaws, and town plan policies can provide community specific protections and guidance to maintain and enhance local water resources. Local protections also afford benefits to downstream communities and water resource users. Towns without zoning do not need to institute comprehensive zoning but have the option to adopt stand-alone flood hazard bylaws. Although a town may have bylaws or town plan policies it does not mean their resources are afforded the strongest protection. Communities should work with NVDA and VDEC staff to identify opportunities that provide their constituents with the highest level of natural resource protection within their means.

In the Passumpsic Basin twelve out of the nineteen towns in the basin participate in the NFIP program as highlighted in the municipal protectiveness table. Several communities, including Lyndon, Burke, St Johnsbury, Granby and Kirby have bylaws that are stricter than the minimum NFIP requirements in regard to limits on the filling of the special flood hazard area. Such standards can further reduce development in the floodplain at high risk for flood damage which maintains flood storage capacity of the floodplain, limiting increases in flood levels that can happen with development under the minimum NFIP requirements.

Communities can also adopt zoning bylaws to protect river corridors. Protecting river corridors helps protect roads and structures from erosive damage, improves water quality, moderates flooding, and enhances wildlife habitat. River corridor protection, limits development close to stream and river channels to allow the channel to establish and maintain a least-erosive path through the valley lessening the need to armor channel edges. Lyndon adopted River Corridor zoning in 2016 and Burke in 2018 but these are the only towns that have adopted river corridor zoning in the

Passumpsic Basin. These river corridor protections are important since these regulations will limit further encroachment and allow the upper Passumpsic tributaries to reestablish floodplain which will slow the transport of sediment and flood waters downstream, reducing peak flood levels which are a major concern for the Village of Lyndonville.

Implementing new development standards can be challenging. Continued support of these community policies is important to help communities explain the benefits and refine implementation of these new standards within the community. Priorities for community outreach are to continue to provide information to the seven communities that don't currently participate in the NFIP program in the basin to encourage participation and provide support as communities consider joining this program. Another priority is to encourage communities to adopt river corridor protections with a focus on communities in the upper watershed, and finally to support communities that have adopted new regulations as these regulations are applied.

Community flood resilience planning and regulations can make a significant contribution to stream stability and equilibrium conditions in the watershed. When new development is placed in a river corridor or floodplain, encroachment on the stream increases the likelihood of conflict with stream adjustment and the desire to channelize the stream to protect property. Given the space, streams can regain their natural stability and floodplain access. Information about municipal flood resilience planning efforts is available online at https://floodready.vermont.gov/.

Partners have identified a need to work with the communities of Sheffield and Wheelock to provide information on Millers Run geomorphic conditions and conservation opportunities for landowners along the river tied into improving fisheries.

Recreational Access and Opportunities

Community members at the Passumpsic River Basin public forum held in November of 2018 emphasized that they would like to increase recreational connectivity to rivers in the watershed. Providing access to the river with opportunities for walking, fishing and boating was identified as a key strategy to increase appreciation for the Passumpsic River and its tributaries and to build support for the actions needed to protect and restore water quality in the Passumpsic River Basin. This desire has been highlighted by the St Johnsbury riverfront committee that would like to increase access between the downtown and the Passumpsic River identified as a need during a community visit. The Town of Lyndon has been working on a restoration and recreation plan for an old town garage site along the Passumpsic River which not only would provide for more opportunities for recreation on the river but remove old buildings and plant riparian buffers. The Passumpsic River Paddling Guide was updated in 2017 and is a great resource for paddling opportunities in the basin which could be better promoted to increase use and appreciation or the River and its tributaries.

Click the following hyperlink to view summary strategies to address Natural Resource Restoration -- Stream connectivity.

Chapter 5 – The Implementation Table

A. Coordination of Watershed Partners

There are several active organizations undertaking watershed monitoring, assessment, protection, restoration, and education and outreach projects in the Passumpsic River Basin. These partners are non-profit, private, state, and federal organizations working on both private and public lands. Partnerships are crucial in carrying out non-regulatory actions to improve water quality. Partners active in working with farms in the basin include Natural Resources Conservation Service (NRCS), Vermont Agency of Agriculture food and Markets (VAAFM), Caledonia County Natural Resources Conservation District (CCNRCD), and Essex County Natural Resources Conservation District (ECNRCD), the Vermont Department of Environmental Conservation (VDEC), UVM Extension Service, Connecticut River Conservancy (CRC), Vermont River Conservancy (VRC) and Northeast Organic Farming Association (NOFA) VT through the Passumpsic and Connecticut Agricultural Work Group. The Northeast Vermont Development Association (NVDA) is key partner in working with towns who are also individually partners on many projects in the basin directly or through several active conservation commissions. There are active watershed and lake organizations including the Passumpsic Valley Land Trust, (PVLT), Joes Pond Association, and the Connecticut River Joint Commission. The NorthWoods Stewardship Center (NWSC) has also been an active partner in the basin in implementing many road and stormwater projects. There are also other active state partners working on water quality issues including Vermont Fish and Wildlife Department (VFWD), the Department of Forests Parks and Recreation, (VFPR) and VTrans. The large amount of work that is necessary to meet water quality targets in this basin require such tight collaborations to maximize the effectiveness of watershed partners.

B. Passumpsic River Basin Implementation Table

The process for identifying priority actions is the result of a comprehensive compilation and review of both internal ANR monitoring and assessment data and reports, and those of our watershed partner organizations. The monitoring and assessment reports include, but are not limited to, stormwater mapping reports, geomorphic assessments, river corridor plans, bridge and culvert assessments, Hazard Mitigation Plans, agricultural modeling and assessments, road erosion inventories, biological and chemical monitoring, lake assessments, fisheries assessments, and natural communities and biological diversity mapping. Many of these assessments identify specific projects which are added to an on-going detailed list of projects that can be viewed via the online as the Watershed Projects database.

These assessment results also guided basin planning meetings with key partners where gaps in funding, technical assistance or technical knowledge necessary to effectively address water quality issues was the focus of discussion. The outcomes of these meetings are the priority strategies to address water quality in the Passumpsic River Basin over the next five years which are identified in Table 12. Many of these strategies represent categories of the many specific projects which are individually catalogued in the watershed project database. The following table serves to identify high priority implementation strategies

and tasks that provide opportunities for stakeholders in surface water management to pursue and secure technical and financial support for implementation. For these priorities to be achieved, partners and stakeholders must help to carry out the actions identified in the basin plan.

Table 12 is organized by land use or pollutant sectors described in Chapter 4 and can be accessed directly by clicking on the bookmarks below:

Table 12. Passumpsic River Basin Implementation Table

Strategy	Priority Area	Town(s)	Partners (see Partners)	Funding
Strategies to address runoff from Agricultural lands.				
1. Continue the development of the Caledonia and Essex agricultural workgroup to support the implementation of RAPs, BMPs, and effective workshops and outreach efforts.			CCNRCD, ECNRCD VAAFM, NRCS, VDEC, UVM Ext.	ACWIP, TBP
2. Host annual workshops on improving soil health, new RAPs, implementing conservation tillage and cover cropping practices.			CCNRCD, ECNRCD VAAFM, NRCS, VDEC, UVM Ext.	RCPP, USDA, ERP, ACWIP
3. Support farmers in developing Nutrient Management Plans (NMPs) through UVM Extension's Digging In course and the development of NMPs for all certified farms through NRCS CAPS funding.	Water Andric, and Millers Run, Joes Pond, and Chesterfield Valley tributary watersheds		CCNRCD, ECNRCD VAAFM, NRCS, UVM Ext.	RCPP, EQIP, ACWIP
4. Recruit and support funding for partners to continue to work with priority farms on implementing NMPs through BMP installation.	Water Andric, and Millers Run, Joes Pond, and Chesterfield Valley tributary watersheds		CCNRCD, ECNRCD, VAAFM, NRCS, VDEC, UVM ext, NOFA	RCPP, USDA, ERP, ACWIP, VAAFM BMP
5. Develop regional equipment sharing programs to support the implementation of conservation practices			CCNRCD, ECNRCD VAAFM, NRCS, UVM Ext.	ACWIP, EQIP, RCPP, VAAFM BMP, ERP
6. Recruit and support funding for increased buffer planting programs across the watershed.			CCNRCD, ECNRCD VAAFM, NRCS, VDEC, CRC	ERP, ACWIP, CREP, RCPP, NFWF
7. Identify high priority sites for water quality monitoring to increase understanding of nitrogen source areas and targeted BMP implementation areas in the Passumpsic and upper Connecticut River watersheds			CCNRCD, ECNRCD VAAFM, VDEC, NRCS, UVM Ext.	LaRosa, ACWIP, TBP

Strategy	Priority Area	Town(s)	Partners (see Partners)	Funding
8. Conduct outreach to farmers with potential natural resource protection opportunities (river corridor or wetlands)				ANR F&W, ANR DEC
Developed Lands-- Stormwater.				
9. Implement green stormwater infrastructure (GSI) projects in areas of St. Johnsbury where sewer and stormwater systems are combined.	St. Johnsbury CSO drainage areas	St. Johnsbury	St. Johnsbury, CCNRCD, VDEC	ERP
10. Add GSI to CSO separation projects as they are designed and built in St. Johnsbury.	St. Johnsbury CSO drainage areas	St. Johnsbury	St. Johnsbury, CCNRCD, VDEC	CWI, ERP
11. Implement priority practices from St. Johnsbury, Lyndon, Concord and Dish Mill Brook Stormwater master plans.	Dish Mill Brook	Lyndon, St. Johnsbury, Concord, Burke	Lyndon, CCNRCD, Burke Mountain Resort	CWI, ERP
12. Develop and implement GSI practices at local schools with a focus on St. Johnsbury Academy, Cornerstone School off of School St, Sutton and Millers Run Schools, Waterford School.		Waterford, St. Johnsbury, Sutton, Sheffield	Local school administrations and towns, VDEC, CCNRCD	CWI, ERP
13. Support brownfields restoration efforts that mitigate surface water pollution generated from these sites.	Sleepers River, Lily Pond Stream watersheds	St. Johnsbury, Lyndon	NVDA, Towns, VDEC	EPA
14. Identify potential stormwater treatment practices in Danville	Water Andric watershed	Danville	Danville, CCNRC	TBP, CWI
Developed Lands -- Roads.				
15. Complete Road Erosion Inventories (REIs) for remaining eight towns in the basin by 12/31/20.		Burke, Newark, St. Johnsbury, Wheelock Concord, East Haven, Victory, Westmore	NVDA, VTrans, CCNRCD, ECNRCD, Towns	Better Roads

Strategy	Priority Area	Town(s)	Partners (see Partners)	Funding
16. Provide workshops and one on one technical support for towns to guide town in the purchase, setup and use of technology to track road segment status.			NVDA, VTrans, CCNRCD, ECNRCD, towns, VDEC, Vermont Local Roads	TPI, TBP
17. Provide support to towns to upload 2017 data into Municipal Roads General Permit (MRGP) database in 2019.		Danville, Lyndon Sheffield, Sutton, Waterford	NVDA, VDEC , VTrans, Towns, CCNRCD, ECNRCD,	TPI, TBP
18. Provide technical assistance to towns for developing project proposals, budgets and funding opportunities for implementing priority projects that have the largest water quality benefits.	Dish Mill Brook, Water Andric, and Millers Run, Joes Pond, Center Pond and Stiles Pond watersheds	Burke, Danville, Walden, Wheelock, Lyndon, Sheffield, Waterford, Newark	NVDA, VTrans, CCNRCD, VDEC, Vermont Local Roads.	TPI, TBP
19. Implement priority road projects in target watersheds along with other priority road projects across the basin to meet MRGP requirements.			Towns, Vtrans	Grant in Aid, BBR, Town funds, VTrans funds
20. Complete projects to address erosion issues on Class 4 roads and legal trails with support from the NWSC watershed work crew.			NWSC, Towns, CCNRCD, VDEC, NVDA, VTrans	CWI, ERP, BBR, Work Crew
21. Host road crew workshops and peer to peer sharing on best practices for using new equipment to meet MRGP standards and support equipment purchase through grant in aid funding.			NVDA, VDEC, VTrans, CCNRCD, ECNRCD, Local Roads	TPI, TBP, Grant in Aid
22. Create an upper watershed hydro seeder sharing programs and other locally supported equipment sharing efforts to meet MRGP requirements.		Lyndon, Burke, Sutton Sheffield	Towns, CCNRCD	Grant in aid – equipment grant
Natural Resource Restoration -- Forest Lands.				
23. Support local land trusts and conservation organizations in conserving forest blocks that are important for protecting water quality in headwater streams.	Bean, Center and Newark ponds watersheds	Headwater areas of Moose River, East and West Branch of the Passumpsic River and Miller Run	Newark, VLT, PVLT	CWI, ERP, VHCB, MEF, TPL, LWCF, TNC, Forest Legacy

Strategy	Priority Area	Town(s)	Partners (see Partners)	Funding
24. Provide outreach, technical assistance and workshops to private forestland owners, foresters and loggers on the revised AMPs and voluntary harvesting guidelines.			ECNRCD, County Foresters, VDFPR	TBP,
25. Continue to support local skidder bridge rental program and increase usage of bridges.			CCNRCD, VDFPR	CWI, ERP
26. Implement forest infrastructure restoration projects on state lands such as culvert replacements or retrofits, road decommissioning where water quality benefits are identified through assessments and long range management plans.			VDFPR, VFWD, TU,	ERP,
Natural Resource Restoration -- Shorelands				
27. Provide outreach to communities around Center Pond and Joes pond to generate interest in Lake Wise Program.	Center and Joes Pond watersheds	Newark, Danville	VDEC, Local Lake Wise Partners	ERP,
28. Complete Lake Wise planning for lakes where there is community support for such efforts.	Center and Joes Pond watersheds	Newark, Danville	VDEC, Local Lake Wise Partners	ERP,
29. Implement priority projects identified in Lake Wise assessments.	Center and Joes Pond watersheds	Newark, Danville	NWSC, CCNRCD, VDEC, Danville, Newark CC, Joes Pond Association.	CWI, ERP
30. Support AIS spread prevention efforts in the Passumpsic River Basin.	Joes Pond	Danville	CCNRCD, DEC, Danville, Joes Pond Association.	ANS grant
31. Support acquisitions in fee or easement for conservation of undeveloped lakeshore habitat on priority lakes and ponds.	Center, Newark, Bean, Peets Ponds	Newark, Burke	PVLT, Lake Associations and towns, Conservation Commissions	MEF, VHCB
Natural Resources Restoration – River Connectivity				
32. Complete a project development effort to contact landowners of potential projects identified in river corridor plans to identify support for moving into design or implementation phases.	Millers Run, East Branch, Water Andric	Danville, Lyndon, Burke, Sutton, Sheffield, Newark	CCNRCD, ECNRCD, CRC, PVLT, VDEC	ERP, MEF

Strategy	Priority Area	Town(s)	Partners (see Partners)	Funding
33. Develop and implement priority river corridor protection projects and floodplain/channel restoration projects where there is landowner support	Millers Run, East Branch, Water Andric	Danville, Lyndon, Burke, Sutton, Sheffield, Newark	CCNRCD, ECNRCD, CRC, PVLT, VDEC	ERP, MEF, EQIP
34. Remove obsolete Lyndonville water system dams, Fairbanks Mill Dam and other priority dams.		Lyndon, Danville	Lyndonville, American Rivers, CRC, CCNRCD, VFW , VDEC	ERP, MEF
35. Initiate a discussion with USGS on the removal of weirs in the Sleepers River watershed that are a barrier to fish and sediment passage and are no longer used for flow gaging.	Sleepers River	Danville	American Rivers, CRC, CCNRCD, Danville, DEC, VFW	ERP, MEF
36. Work with towns to retrofit or replace priority culverts to restore fish passage.			CCNRCD, ECNRCD, Towns, NVDA, VFW	ERP, MEF, Better Roads, SWIG
37. Target strategic wood additions in the East and West branches of the Moose River as well as Line Brook to restore Brook Trout habitat in these streams which were historically impacted by logging operations.	Upper Moose River	East Haven, Granby	VFW, TU	ERP, MEF
38. Continue buffer plantings along rivers in priority locations through CREP, Trees for Streams program.	Joes Pond, Water Andric, Millers Run, East Branch	Danville, Walden, Lyndon, Wheelock, Sheffield	CCNRCD, ECNRCD, VFW, NRCS, PVLT, CRC, TU	ERP, MEF, RCPP, NFWF, TU
39. Work with communities of Sheffield and Wheelock to provide information on Millers Run geomorphic conditions and conservation opportunities for landowners along the river tied into fisheries.	Millers Run	Sheffield, Wheelock	CCNRCD, VDEC, VFW, NVDA, CRC	TBP, MEF, RCPP, NFWF
40. Provide information on the benefits of the NFIP program and technical support for towns that are interested in joining the program.	East Branch, Millers Run	Sheffield, Newark, Wheelock, East Haven, Victory, Walden	VDEC, NVDA, Towns	TBP

Strategy	Priority Area	Town(s)	Partners (see Partners)	Funding
41. Provide support to Lyndon and Burke to continue River corridor protections in bylaws as a key strategy to allow East Branch and Millers Run to establish new floodplain.	East Branch, Millers Run	Lyndon, Burke	VDEC, CCNRCD, NVDA	TBP
42. Provide support on community projects to provide access to rivers for recreation while maximizing riparian restoration opportunities and minimizing any permanent constraints on rivers.	Passumpsic River, East and West Branch, Sleepers, Moose River	St Johnsbury, Lyndon, Burke, Concord	Towns, CCNRCD, PVLT, VFW, NVDA, VDEC	MEF, Rec Trails Grants, ERP (for restoration)

C. Monitoring Priorities Table

This section identifies monitoring priorities for the Passumpsic River Basin across several monitoring programs to achieve a number of monitoring goals. As described in the What is a tactical basin plan section – the planning process is broken down into a 5 year planning cycle and the Passumpsic River Basin is up for targeted monitoring in 2020. While 2020 is the target year for monitoring in this basin several monitoring programs monitor water quality in the Basin on an ongoing basis. There are a wide variety of monitoring programs that are supported by the Department and its partners which are described in detail in the Water Quality Monitoring Program Strategy. Monitoring programs in this basin include the Biological and Aquatic Studies Section (BASS) – that focuses on biological monitoring of macroinvertebrate and fish communities as well as targeted chemistry sampling around WWTF or other pollution concerns. This section also supports the LaRosa volunteer water quality monitoring program. The Vermont Fish and Wildlife Department supports fish assessments which are used to understand fish populations – and does temperature monitoring and the evaluation of streams for the need to strategically add wood to restore habitat. The Lakes and Ponds Program supports the spring phosphorus monitoring and lay monitoring programs which evaluate nutrient conditions and trends on lakes, as well as shoreland condition and more in depth lake assessments in addition to surveys for aquatic invasive species. Finally, the Rivers Program supports stream geomorphic assessments that evaluate geomorphic and habitat conditions on our rivers and the Wetlands programs has a wetlands assessment program.

There are several common goals for monitoring efforts across programs which include:

1) The confirmation of waters quality conditions that support reclassification of surface waters to a higher level where there is not sufficient amounts of data or data is too old to support reclassification which is a focus for the BASS with regards to aquatic biota and VFWD program with regard to fishing use.

2) To understand water quality conditions where these are unknown such as streams or lakes that have not been sampled or assessed or where assessments may be out of date.
3) To understand water quality conditions where there is a known water quality problem – to evaluate if the problem has gotten worse or to evaluate the effectiveness of restoration efforts.
4) To understand pollution source areas that may be contributing to water quality issues such as nitrogen loading regarding LIS.
5) To evaluate water quality changes over time – as supported by sentinel monitoring network on lakes and streams or targeted studies to evaluate water quality improvements with the implementation of best management practices.

Table 13 is an initial list of water quality monitoring priorities to guide monitoring over the next 5 years. This list has more sites than there is capacity to sample so will need to be further prioritized and this list will be adjusted based on new information at a monitoring summit early in 2020 before the 2000 monitoring season.

Table 13. Passumpsic River Basin priorities for monitoring and assessment. VFWD locations are based on stream elevation in meters and BASS on stream mile.

Waterbody	Assessment Goal	Priority	Location	Partner(s)	Monitoring action
1. Arcadia Brook	Eval. B(1) biota	Moderate	0.3	BASS	Data to support reclassification
2. Bald Hill Pond	Eval. Nutrient Trend	High		Lakes Program	Spring Phosphorus testing / LMP / Watershed and shoreline survey/land use and flow accumulation analysis
3. Barnes Brook	Eval. B(1) biota	Moderate	0.1	BASS	Data to support reclassification
4. Bean Brook	Eval. B(1) biota	High	5.2, 4.8	BASS	Data to support reclassification B(1) which is a priority for Newark Conservation Commission
5. Berry Hill Brook	Eval. B(1) fishing	Moderate	290 - 304 m	VFWD	Requires further VFWD fish sampling
6. Bog Brook	Eval. wood addition	High		VFWD	Scout for large woody material
7. Brown Brook	Eval. B(1) fishing	Moderate		VFWD	Requires further VFWD fish sampling
8. Brown Pond	Eval. Nutrient Trend	Moderate		Lakes Program	Spring Phosphorus testing/AIS
9. Bruce Pond	Eval. Nutrient Trend	Moderate		Lakes Program	Spring Phosphorus testing
10. Burroughs Brook	Eval. B(1) biota	Moderate		BASS	Data to support reclassification
11. Calendar Brook	Support (B1) / wood addition	High	11.2	BASS/VFW	Requires data to remain candidates for aquatic biota reclassification in 2022 if reclass hasn't taken place yet./ Scout for large woody material
12. Calendar Brook Trib 22	Support (B1)	High		BASS	Requires data to remain candidates for aquatic biota reclassification in 2022 if reclass hasn't taken place yet.
13. Calendar Brook Trib 24	Support (B1)	High		BASS	Requires data to remain candidates for aquatic biota reclassification in 2022 if reclass hasn't taken place yet.

Waterbody	Assessment Goal	Priority	Location	Partner(s)	Monitoring action
14. Center Pond	Eval. Nutrient Trend	High		Lakes Program	Spring Phosphorus testing or LMP
15. Chesterfield Valley Brook	Evaluate WQ issue	High		LaRosa	E. coli sampling
16. Clark Brook	Support (B1)	High		BASS	Requires data to remain candidates for aquatic biota reclassification in 2022 if reclass hasn't taken place yet.
17. Cold Brook	Eval. wood addition	High		VFWD	Scout for large woody material
18. Copeland Reservoir tributary	Eval. Reclass from A(2)	High		BASS	Data to support reclassification from A(2) to either B(1) or B(2).
19. Cow Mountain Pond	Eval. Nutrient Trend	Moderate		Lakes Program	Spring Phosphorus testing
20. Dish Mill Brook	Evaluate WQ issue	High		BASS	Bug and Fish Historic Sites
21. Dish Mill Brook Tributary	Evaluate WQ issue	High		BASS	Bug and Fish Historic Sites
22. Dollof Inlet	Eval. B(1) fishing	Moderate	564 m	VFWD	Requires further VFWD fish sampling
23. Duck Pond (Waterford)	Eval. Nutrient Trend	Moderate		Lakes Program	Spring Phosphorus testing/AIS
24. Dunn Mountain Brook	Eval. B(1) fishing/Eval. B(1) biota	Moderate	297 m, 0.2	VFWD/BASS	Requires further VFWD fish sampling/ Data to support reclassification
25. East Branch Passumpsic	Geomorphic cond.	Moderate	Above/below East Burke	Rivers/CCNRCD	SGA could help evaluate adjustments after East Burke dam removal project.
26. East Branch Passumpsic River	Eval. B(1) biota	Moderate	8.9	BASS	Data to support reclassification
27. Fall Brook	No Data	High		BASS	Potential Water quality Issue with road runoff
28. Flower Brook	Old Data	Low		BASS	Has not has recent assessment.
29. Goslants Mill Pond	Eval. Nutrient Trend	Moderate		Lakes Program	Spring Phosphorus testing/AIS/Shoreland
30. Hawkins Brook	Eval. B(1) fishing	Moderate	288 ft	VFWD	Requires further VFWD fish sampling
31. Houghton Brook	Eval. B(1) fishing	Moderate	335 ft	VFWD	Requires further VFWD fish sampling
32. James Brook	Eval. wood addition	High		VFWD	Scout for large woody material
33. Joes Brook	Eval. B(1) biota	High	10.7, 10.5, 8.6, 10.6, 10.8	BASS	Data to support reclassification
34. Joes Pond	Eval. Nutrient Trend	High		Lakes Program	Spring Phosphorus testing or LMP
35. Jones Brook	Eval. B(1) fishing	Moderate	506 m	VFWD	Requires further VFWD fish sampling
36. Kirby Pond	Eval. Nutrient Trend	Moderate		Lakes Program	Spring Phosphorus testing/AIS
37. Lily Pond Outlet	Evaluate WQ issue	High		BASS	Metals sampling
38. Lower South Wheelock	No Data	Moderate		BASS	

Waterbody	Assessment Goal	Priority	Location	Partner(s)	Monitoring action
39. Lyford Pond	Eval. Shoreland	Moderate		Lakes Program	Shoreland development status
40. Marl Pond	Eval. Nutrient Trend	Moderate		Lakes Program	Spring Phosphorus testing/AIS/Shoreland
41. Mathewson Brook	Eval. wood addition	High		VFWD	Scout for large woody material
42. Mathewson Reservoir tributary	Eval. Reclass from A(2)	High		BASS	Data to support reclassification from A(2) to either B(1) or B(2).
43. Miller Run, above Dunne Mtn Trib	No Data	Moderate		BASS	
44. Millers Run	Eval. B(1) fishing/Evaluate WQ issue	Moderate	257 – 265 m	VFWD/BASS	Requires further VFWD fish sampling/Sample more embedded riffles
45. Moose River	Eval. B(1) biota	Moderate	0.1, 1.7	BASS	Data to support reclassification
46. Moose River	Evaluate WQ issue	High	East St Johnsbury	LaRosa	E. coli sampling
47. Morrill Brook	Eval. B(1) fishing	Moderate	359-467 m	VFWD	Requires further VFWD fish sampling
48. Mud (Granby)	Eval. AIS	Low		Lakes Program	AIS
49. Nation Brook Trib 3	Support (B1)	High		BASS	Requires data to remain candidates for aquatic biota reclassification in 2022 if reclass hasn't taken place yet.
50. Passumpsic River	Eval. B(1) biota	Moderate	6.7, 4.9, 8.6	BASS	Data to support reclassification
51. Passumpsic River	Eval. B(1) biota	Moderate	12.9, 14.3, 14.5, 14	BASS	Data to support reclassification
52. Passumpsic River	Geomorphic cond.	High	From the East Branch to Vale Dam	Rivers/CCNRCD	SGA needed to support restoration – zoning.
53. Pope Brook	Evaluate WQ issue			BASS	Fish data suggests stressed conditions – need to evaluate cause
54. Pope Brook	Eval. B(1) fishing	Moderate	412 -515 m	VFWD	Requires further VFWD fish sampling
55. Pope Brook Trib	Eval. B(1) biota	Low	0.1	BASS	Data to support reclassification (old data – very small stream)
56. Rake Factory Brook	No Data	High		BASS/LaRosa	Danville Conservation Commission has interest in this stream – potential for Chem monitoring
57. Rake Factory Brook	Eval. B(1) fishing	Moderate	213 -220 m	VFWD	Requires further VFW fish sampling
58. Rock Brook	Eval. wood addition	High		VFWD	Scout for large woody material
59. Roundy Brook	No Data	High		BASS	Interest for Burke CC- potential higher pollutant levels due to developed and Ag land use and road runoff.
60. Roy Brook	Eval. B(1) biota	Moderate	0.1, 1.3	BASS	Data to support reclassification

Waterbody	Assessment Goal	Priority	Location	Partner(s)	Monitoring action
61. Sawdust Pond	Eval. Nutrient Trend/ Sed. Stress	High		Lakes Program	Spring Phosphorus testing/AIS/Shoreland
62. Simpsons Brook	Evaluate WQ issue	Moderate		BASS	Sample Fish at Historic Sites
63. Sleepers River	Evaluate WQ issue	High		BASS	Sample for heavy metals and organics
64. South Wheelock Branch	Eval. B(1) biota/Geomorphic cond.	Moderate		BASS	Data to support reclassification & SGA needed to support restoration – zoning.
65. Steam Mill Brook	Eval. B(1) biota / wood addition	High	5.5	BASS	Evaluate fish community conditions/ Scout for large woody material
66. Stiles Brook	Eval. B(1) biota	Moderate		BASS	Data to support reclassification
67. Stiles Pond	Eval. DO stress	Moderate		Lakes Program	Spring Phosphorus testing
68. Sutton River	No Data	Moderate		BASS	
69. Umpire Brook	Eval. wood addition	High		VFWD	Scout for large woody material
70. Upper Danville Pond	Eval. Nutrient Trend	Moderate		Lakes Program	Spring Phosphorus testing/AIS/Shoreland
71. Water Andric	Evaluate WQ issue	High		BASS/ LaRosa	Bug Fish and Chemistry (LaRosa)
72. Weir Mill Brook	Eval. wood addition	High		VFWD	Scout for large woody material
73. West Branch Passumpsic	Eval. B(1) fishing/ Eval. B(1) biota	Moderate	244 - 306 m / 3.4	VFWD/BASS	Requires further VFWD fish sampling/Data to support reclassification

List of Acronyms

604(b)	Federal Clean Water Act, Section 604b
ACWIP	Agricultural Clean Water Initiative Grant Program
AIS	Aquatic Invasive Species
AMPs	Acceptable Management Practices (for logging)
ANS	Aquatic Nuisance Species
AOP	Aquatic Organism Passage
BASS	VDEC Biomonitoring and Aquatic Studies Section
BMP	Best Management Practices
CCNRCD	Caledonia County Natural Resources Conservation District
CRC	Connecticut River Conservancy
CREP	Conservation Reserve Enhancement Program
CWI	Clean Water Initiative Grant Funding
CWIP	Clean Water Initiative Program
CWSRF	Clean Water State Revolving Fund
DWSRF	Drinking Water State Revolving Fund
EBTJV	Eastern Brook Trout Joint Venture
ECNRCD	Essex County Natural Resources Conservation District
EQIP	Environmental Quality Incentive Program
ERP	Ecosystem Restoration Program
FAP	Farm Agronomic Practices
GIS	Geographic Information System
GSI	Green Stormwater Infrastructure
IDDE	Illicit Discharge Detection (and) Elimination
LFO	Large farm Operation
LiDAR	Light Detection and Ranging
LIS	Long Island Sound
LTP	Land Treatment Plan
LWCF	Land and Water Conservation Fund
MAPP	Monitoring, Assessment and Planning Program
MEF	Upper Connecticut River Mitigation and Enhancement Fund
MFO	Medium Farm Operation
MPG	Municipal Planning Grant
MRGP	Municipal Roads General Permit
NEKRR	Northeast Kingdom Roads and Rivers Workgroup
NFIP	National Flood Insurance Program
NFWF	National Fish and Wildlife Foundation
NMP	Nutrient Management Plan
NPS	Non-point source pollution
NRCD	Natural Resources Conservation District

NRCS	Natural Resources Conservation Service
NVDA	Northeast Vermont Development Association
NWSC	NorthWoods Stewardship Center
ORW	Outstanding Resource Water
PDM	Pre-Disaster Mitigation
PVLT	Passumpsic Valley Land Trust
RAP	Required Agricultural Practices
RTE	Rare, Threatened and Endangered Species
RCPP	Regional Conservation Partnership Program
RMP	River Management Program
RPC	Regional Planning Commission
SFO	Small Farm Operation
SGA	Stream Geomorphic Assessment
SWG	State Wildlife Grants
SWMP	Stormwater master plans
TBP	Tactical Basin Plan
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
TS4	Transportation Separate Storm Sewer System General Permit
TPL	Trust for Public Lands,
TU	Trout Unlimited
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UVA	Use Value Appraisal program, or Current Use Program
UVM Ext.	University of Vermont Extension Service
VAAFM	Vermont Agency of Agriculture, Food, and Markets
VACD	Vermont Association of Conservation Districts
VANR	Vermont Agency of Natural Resources
VDEC	Vermont Department of Environmental Conservation
VDFPR	Vermont Department of Forests, Parks and Recreation
VFWD	Vermont Fish and Wildlife Department
VHCB	Vermont Housing and Conservation Board
VIP	Vermont Invasive Patrollers
VLCT	Vermont League of Cities and Towns
VLRP	Vermont Local Roads Program
VLT	Vermont Land Trust
VRC	Vermont Rivers Conservancy
VTrans	Vermont Agency of Transportation
VWQS	Vermont Water Quality Standards

Glossary

10 V.S.A., Chapter 47 - Title 10 of the Vermont Statutes Annotated, Chapter 47, Water Pollution Control, which is Vermont's basic water pollution control legislation.

Accepted Agricultural Practices (AAP) - land management practices adopted by the Secretary of Agriculture, Food and Markets in accordance with applicable State law.

Acceptable Management Practices (AMP) - methods to control and disperse water collecting on logging roads, skid trails, and log landings to minimize erosion and prevent sediment and temperature changes in streams.

Aquatic biota - all organisms that, as part of their natural life cycle, live in or on waters.

Basin - one of fifteen planning units in Vermont. Some basins include only one major watershed after which it is named such as the Lamoille River Basin. Other Basins include two or major watersheds such as the Poultney/Mettawee Basin.

Best Management Practices (BMP) - a practice or combination of practices that may be necessary, in addition to any applicable Accepted Agricultural or Silvicultural Practices, to prevent or reduce pollution from nonpoint source pollution to a level consistent with State regulations and statutes. Regulatory authorities and practitioners generally establish these methods as the best manner of operation. BMPs may not be established for all land use sectors but are often listed by professional associations and regulatory agencies as the best manner of operation for a particular industry practice.

Classification - a method of designating the waters of the State into categories with more or less stringent standards above a minimum standard as described in the Vermont Water Quality Standards.

Designated use - any value or use, whether presently occurring or not, that is specified in the management objectives for each class of water as set forth in §§ 3-02 (A), 3-03(A), and 3-04(A) of the Vermont Water Quality Standards.

Existing use - a use that has actually occurred on or after November 28, 1975, in or on waters, whether or not the use is included in the standard for classification of the waters, and whether or not the use is presently occurring

Farm production area - means those areas of a farm where animals, agricultural inputs, or raw agricultural products are confined, housed, stored, or prepared whether within or without structures, including barnyards, raw materials storage areas, heavy use areas, fertilizer and pesticide storage areas, and waste storage and containment areas. Production areas include egg washing or egg processing facilities, milkhouses, raw agricultural commodity preparation or storage, or any area used in the storage, handling, treatment, or disposal of mortalities.

Fluvial geomorphology - a science that seeks to explain the physical interrelationships of flowing water and sediment in varying land forms

Impaired water - a water that has documentation and data to show a violation of one or more criteria in the Vermont Water Quality Standards for the water's class or management type.

Mesotrophic – An intermediate level of nutrient availability and biological productivity in an aquatic ecosystem.

Natural Community - An interacting assemblage of organisms, their physical environment, and the natural processes that affect them.

Natural condition - the condition representing chemical, physical, and biological characteristics that occur naturally with only minimal effects from human influences.

Nonpoint source pollution - pollution that reaches waters in a diffuse manner from any source other than a point source including, but not limited to, overland runoff from construction sites, or as a result of agricultural or silvicultural activities.

pH - a measure of the hydrogen ion concentration in water on an inverse logarithmic scale ranging from 0 to 14. A pH under 7 indicates more hydrogen ions and therefore more acidic solutions. A pH greater than 7 indicates a more alkaline solution. A pH of 7.0 is considered neutral, neither acidic nor alkaline.

Point source - any discernible, confined and discrete conveyance including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which either a pollutant or waste is or may be discharged.

Production Area - means those areas of a farm where animals, agricultural inputs, or raw agricultural products are confined, housed, stored, or prepared whether within or without structures, including barnyards, raw materials storage areas, heavy use areas, fertilizer and pesticide storage areas, and waste storage and containment areas. Production areas include egg washing or egg processing facilities, milkhouses, raw agricultural commodity preparation or storage, or any area used in the storage, handling, treatment, or disposal of mortalities.

Riparian vegetation - the native or natural vegetation growing adjacent to lakes, rivers, or streams.

River Corridor - the land area adjacent to a river that is required to accommodate the dimensions, slope, planform, and buffer of the naturally stable channel and that is necessary for the natural maintenance or natural restoration of a dynamic equilibrium condition, as that term is defined in 10 V.S.A. §1422, and for minimization of fluvial erosion hazards, as delineated by the Agency in accordance with the VANR River Corridor Protection Guide.

Sedimentation - the sinking of soil, sand, silt, algae, and other particles and their deposition frequently on the bottom of rivers, streams, lakes, ponds, or wetlands.

Thermal modification - the change in water temperature

Turbidity - the capacity of materials suspended in water to scatter light usually measured in Nephelometric Turbidity Unit (NTU). Highly turbid waters appear dark and "muddy."

Waste Management System -a planned system in which all necessary components are installed for managing liquid and solid waste, including runoff from concentrated waste areas and silage leachate, in a manner that does not degrade air, soil, or water resources. Such systems are planned to preclude discharge of pollutants to surface or ground water and to recycle waste through soil and plants to the fullest extent practicable.

Water Quality Standards - the minimum or maximum limits specified for certain water quality parameters at specific locations for the purpose of managing waters to support their designated uses. In Vermont, Water Quality Standards include both Water Classification Orders and the Regulations Governing Water Classification and Control of Quality.

Waters - all rivers, streams, creeks, brooks, reservoirs, ponds, lakes, springs and all bodies of surface waters, artificial or natural, which are contained within, flow through or border upon the State or any portion of it.

Watershed - all the land within which water drains to a common waterbody (river, stream, lake pond or wetland).

Wetlands - are places where land and water meet which may be inundated or saturated by water for a few weeks of the year to shallow water year round. Vermont's wetlands are defined as those areas of the state that are inundated by surface or ground water with a frequency sufficient to support plants and animals that depend on saturated or seasonally saturated soil conditions for growth and reproduction. These areas are commonly known as ponds, bogs, fens, marshes, wet meadows, shrub swamps, and wooded swamps.

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Appendix A. Existing Uses in Basin 15

Swimming

Most of the swimming in the basin takes places on the many lakes and ponds which have a presumed existing use of contact recreation. During the 2014 tactical basin planning process three locations of swimming use on rivers were identified as listed below.

Table 14. Swimming as an existing use of specific waters within the Passumpsic River Basin.

Location	Town	Description
Emerson Falls swimming hole - Sleepers River	Saint Johnsbury	Off of Emerson Falls Road above and below the waterfall.
East Burke village swimming hole – East Branch Passumpsic River	Burke	Swimming hole used by mountain bikers and local residents for swimming in the village
East Burke park swimming hole – East Branch Passumpsic River	Burke	Lightly used swimming hole on the East Branch of the Passumpsic River.

Recreational Boating

It is the Agency's long-standing stipulation that all lakes and ponds in the basin have existing uses of boating and so only boating locations on rivers are listed below. Several locations are good whitewater or flatwater boating stretches in the basin; some highly rated by the Vermont Paddlers Association, listed in the AMC or Vermont White Water Rivers. The Passumpsic River Paddling Guide was updated in 2017 and is a great resource for paddling opportunities in the basin.

Table 15. Recreational boating as an existing use of specific waters within the Passumpsic River Basin.

Location	Documentation	Characteristics that support that use	Put in	Take out
Moose River Victory through St Johnsbury	AMC River Guide, Vermont's White Water Rivers	Flat water to Class III rapids. Remote stream with wetland scenery through Victory Bog.	Victory Basin WMA	Fred Mold Park
East Branch Passumpsic River (11 miles)	Vermont's White Water Rivers	Class I and II rapids rural scenery.	Rt. 114 Bridge in Newark	Lily Pond Road/Passumpsic River access or PVLT lands at the confluence with West

				Branch
Passumpsic River West Branch confluence to Connecticut River	AMC River Guide, Passumpsic River boating guide		Lily Pond Road or PVLT lands at the confluence with West Branch	Connecticut River access in Barnet

Public Water Sources

Table 16. Public water sources as an existing use within the Passumpsic River Basin.

Water Body	Town	Documentation
Stiles Pond	Brighton	Town of St. Johnsbury water supply
Danville Reservoir - Tributary to Brown Brook	Brighton	Danville emergency water supply

Appendix B. 2014 Passumpsic River Basin Report Card

Table 5 below is organized in four columns, the first of which describes the action, the second lists the lead and key players that will be implementing the actions, the third includes the potential funding sources, and the fourth column includes the priority and status of the action to be completed. The 2014 plan included both the Passumpsic and Upper Connecticut River basins but just the Passumpsic focused actions are listed in this report card. Status of actions is listed as not started, in progress or completed – and 2019 notes that this action or a similar one is being carried forward into the 2019 tactical basin plan. 27% of strategies are identified as in progress 27% are identified as completed while another 46% have not been started since 2014 plan was published.

Table 5. Implementation Table - Restoration, Protection, Assessment and Monitoring Actions – All actions are scheduled to be implemented from 2014-2019

Action	Lead/Key Players	Funding	Status	Priority/Update
Objective 1: Protect and restore high quality waters in the basin through reclassification to A(1) waters or Class 1 wetlands, Outstanding Resource Water (ORW) designation, or restoration through strategic woody debris placement. --*Related potential stressors Encroachment and Land Erosion* **Priority areas - see Figure 3**				
1. **VANR recommends that the Calendar Brook Trib 22, and Nation Brook Trib 3 be considered as candidates for reclassification to Class A(1) waters.**	**VANR/**		Not Started 2019 plan	Top 10/ DEC is pulling together a list of waters for reclassification and these are included for A(1) or B(1) consideration
2. **Petition for the reclassification of Victory Basin as Class 1 Wetland.**	**VTDEC/** VFWD, Consultants		Not Started 2019 plan	Top 10/ Mapping of potential class 1 wetland identified and site visit planned for spring of 2019
3. **Complete biological assessments and other assessments to evaluate reclassification of Dish Mill Brook above Mile 2.1 as Class A(1) waters.**	**VANR/** Burke CC		In progress 2019 plan	High/ DEC is pulling together a list of waters for reclassification to be included for B(1) consideration.
4. **Reclassify six historical water supplies from Class A(2) waters to Class B waters.**	**VTDEC**/ Burke, Lyndon,		Not Started 2019 plan	High/ No Action however there are efforts to remove dams for some reservoirs. Will consider B(1) for reclassification in addition to B(2).
5. **Identify high priority lakes for protection or reclassification.**	**VTDEC**		Not Started 2019 plan	High/
6. **Improve lakeshore buffer protections in town zoning bylaws for lakes and ponds in the basin.**	**Towns/**NVDA, VTDEC, NRCD, Lake Associations.	604(b)	Not Started	High/Shoreland regulations have been passed at the state level which largely protect lakeshore buffers.
7. **Support easements or conservation of undeveloped lakeshore habitat on priority lakes and ponds.**	**VANR/** Lake Assn., Land trusts, landowners	VHCB, UCRM&E	2019 plan	Medium/

Action	Lead/Key Players	Funding	Status	Priority/Update
Objective 2: Reduce prevalence of and damage caused by flooding in Lyndonville and erosion hazards throughout watershed. *Related stressors: Channel erosion and Encroachment* **Priority areas: Lyndonville and upstream watershed for flooding and Millers Run, East and West Branches, South Wheelock Branch and Sleepers River for Erosion Hazards (see Figure E2)**				
8. **Improve river corridor and floodplain protections for the Passumpsic, Millers Run, East and West Branch Passumpsic River in town zoning bylaws to allow these streams to develop new floodplains and reduce flood damage.**	**Towns/**NVDA, CCNRCD, VTDEC	ERP, UCRM&E, Municipal planning grants	In progress 2019 plan	Top 10/ Lyndon and Burke have adopted new river corridor bylaws! Other towns have considered but have not adopted new bylaws.
9. **Complete Phase 1 and targeted Phase 2 assessments on unassessed tributaries in the lower watershed.**	**CCNRCD /** Towns, NVDA, VTDEC	ERP	Completed	High/ Phase 2 completed 2014 except for Joes brook
10. **Meet with towns to discuss updating zoning bylaws to address erosion hazards after completion of Phase 2 assessments in the lower Passumpsic River watershed.**	**Towns/**NVDA, CCNRCD, VTDEC	PDM, 604(b)	In progress	High/ Some discussion with the town of Danville
11. **Complete priority river corridor protection projects recommended in Phase 2 SGA reports (Figure E2).**	**Towns/** NVDA, CCNRCD, VTDEC	ERP, UCRM&E	In progress 2019 plan	High/ Water Andric bridge project completed. Unsure of how to move other projects forward
12. **Finalize and get FEMA approval for all hazard mitigation plans for Lyndon and upstream towns as well as towns interested in receiving increased state match under the Emergency Relief and Assistance Fund.**	**Lyndon/** NVDA, CCNRCD, VTDEC, FEMA	PDM	Completed	Medium/
13. **Support implementation of mitigation measures listed in all hazard mitigation plans including the removal of repeat flooding structures and evaluation of other mitigation measures to reduce future flood losses.**	**Lyndonville/** NVDA, CCNRCD, VTDEC, FEMA	PDM	In progress	Medium/ Lyndon town garage site grant application for design has been submitted.
14. **Complete priority buffer planting projects recommended in Phase 2 SGA reports through Trees for Streams program or CREP program (Figure E3)**	**Towns/** NVDA, CCNRCD, VTDEC	ERP, Watershed grants	In progress 2019 plan	Medium/ update??
15. **Support Low Impact Development (LID) standards and the use of Green Stormwater Infrastructure (GSI) in the**	**Towns/** NVDA, CCNRCD, VTDEC	ERP, VANR, 604(b)	In progress	Medium/ Lyndon stormwater master plan and small scale project implementation.

Action	Lead/Key Players	Funding	Status	Priority/Update
watershed and protections of wetlands and floodplains that store floodwaters upstream.				
Objective 3: Create a better understanding of water quality conditions in the Passumpsic and upper Connecticut River watershed addressing waters with elevated E. *coli* levels, swimming holes not previously sampled, potential nitrogen, sediment and phosphorus source areas. *Related stressors: Pathogens, Nutrients non erosion, Channel Erosion, Land Erosion.* **Priority Areas: Moose River and Gauge Brook, Connecticut River at swimming holes and Halls Stream, swimming holes, agricultural and developed land areas – areas with high densities of back roads and logging operations (see Tables 1 and 3.)**				
16. **Implement an intensive water quality monitoring program to evaluate phosphorus, nitrogen, sediment and *E. coli* sources in the Basin. Use sampling results to identify pollution sources in the basin and work with basin partners to address these.**	**ECNRCD/** CCNRCD, CRJC, Coos County NRCD, CRC, VTDEC, Consultants, Burke Conservation Commission	ERP, Watershed grants, LaRosa partnership, private funding sources	In progress 2019 plan	Top 10/Should include plan of action in tactical basin plan. Burke sampling program was done done for one year
Objective 4: Resolve Passumpsic and Sleepers River *E. coli* impairments and complete assessments in areas of potential *E. coli* contamination. -- *Related stressor: Pathogens* **Priority Areas: St. Johnsbury CSO locations and assessment needed for Moose River and Gauge Brook, Connecticut River in select locations and Joes Pond (see Figure 5.)**				
17. **Complete stormwater separation project for the St. Johnsbury WWTP to end Combined Sewer Overflows.**	**St. Johnsbury/** VTDEC	Clean Water State Revolving Fund, Town	In progress 2019 plan	Top 10 / ongoing separation projects
18. **Evaluate potential for GSI to reduce CSO frequency in the Tremont Street neighborhood or similar target watershed.**	**St. Johnsbury/** VTDEC, CCNRCD, NVDA	ERP, Clean water state revolving fund	Completed	Top 10/ Tremont street project going forward along with others to reduce CSO issues…
19. **Identify opportunities for increased treatment of separated stormwater before it is discharged to surface waters through the use of GSI.**	**St. Johnsbury/** VTDEC, CCNRCD	ERP, Town	In progress 2019 plan	High/CCNRCD ERP grant funded sediment separator.
20. **Where elevated levels of *E. coli* are confirmed in agricultural areas based on water sampling, target BMP projects on farms to reduce manure runoff in these areas.**	**ARS/** VAAFM, NRCS, NRCD, VTDEC	MEF, ERP, Watershed Grant	Not Started 2019 plan	High -if identified/
21. **Continue one additional season of *E. coli* sampling at Joes Pond to determine if elevated *E. coli* levels from 2012 recur and if elevated levels recur, work to identify and address *E. coli* sources.**	**Danville/** Joes Pond Ass., VTDEC	VTDEC staff, Town, Watershed grant, LaRosa	Completed	High/ 2013 sampling meet water quality standards. No evidence of continued *E. coli* issue….

Action	Lead/Key Players	Funding	Status	Priority/Update
Objective 6: Reduce nitrogen loading to the Connecticut River and Long Island Sound. *Related stressors: Nutrient loading (non-erosion)* **Priority Areas: Basin wide with focus on sources areas shown in Figure 7.**				
22. **Complete outreach to farmers to improve nitrogen management on farms through the use of Adapt N software, pre side dress nitrate testing and demonstrating the use of shorter duration corn with legume cover crops.**	**UVM Ext/** NRCD, VAAFM, NRCS	Long Island Sound Futures fund, 319	In progress 2019 plan	Top 10/ UVM ext staff leading project has moved on – need to check on status of these efforts.
23. **Reduce nitrogen loading from wastewater treatment plants as identified in WSMD wasteload allocation plan.**	**VTDEC/** Towns	Clean water state resolving fund, Local funding	Completed	High/Lyndon reduced TN loading significantly
24. **Identify potential nitrogen sources and highest priority BMP's for reducing nitrogen runoff from agricultural and developed lands in the Basin.**	**ARS/** NRCS, VTDEC, NRCD, VAAFM	ERP, MEF	In progress 2019 plan	High/ Stormwater master plans have identified high priority projects. Farm priorities need to be identified.
25. **Complete IDDE in Danville, Lyndonville, Concord.**	**VTDEC/** CCNRCD, Towns	ERP	Completed	Medium/
26. **Complete BMP's to address nitrogen runoff as suggested by studies above or low cost strategies such as buffer plantings in locations targeted to filter runoff or with other local water quality benefits targeting areas identified in Figure 7.**	**VTDEC/** Lake Associations, VTDEC, NRCD's	EQIP, ERP, MEF, AG BMP, CREP, CRP	In progress 2019 plan	Medium/ some small scale stormwater projects installed, buffer plantings completed, Ag BMP's widely applied.
Objective 7: Improve the biological condition of Dish Mill Brook which is stressed by increased scour from stormwater flows and sedimentation. -- *Related stressors: Channel Erosion, Land Erosion.* **Priority Areas: Dish Mill Brook tributary and adjacent drainage to Dish Mill Brook(see Figure 5)**				
27. **Complete a stormwater master plan in the Dish Mill Brook Watershed working with key partners to identify stormwater and sediment source areas, treatment options, and required maintenance schedule for proposed as well as existing infrastructure.**	**CCNRCD/** VTDEC**,** Q Burke, Town of Burke, Kingdom Trails, VDFPR, Homeowner Associations, NVDA	ERP, Municipal planning grants, 604(b), Private or local funding	Completed	Top 10/ See memo with summary of actions.
28. **Complete Better Backroads assessment and projects for High Meadow Road, the Mountain Road as well as other town and private roads in the Dish Mill Brook Watershed.**	**CCNRCD**/ Q Burke, VTDEC, Homeowner Associations, Town of Burke	Better Backroads Grants, Private or local funding, ERP	Completed	High/ Road projects completed in 2017 with details included in memo.

Action	Lead/Key Players	Funding	Status	Priority/Update
29. **Work with towns to develop zoning bylaws to protect pre-development hydrology and minimize increases in sediment and stormwater in this watershed. Bylaws should also protect natural features such as wetlands, streams, floodplains, and riparian buffers.**	**Town of Burke /** VTDEC, NVDA	Municipal planning grants, 604(b)	Not started	High/ Progress on floodplain and river corridor protection for Lyndon and Burke– less so in other areas.
30. **Implement high priority sediment reduction and stormwater treatment projects identified through stormwater master planning including low impact development retrofits and roadway erosion control projects if identified as a priority.**	**Q Burke/** VTDEC, CCNRCD, VDFPR	Private or local funding, ERP, Dry hydrant funding, Better Backroads Grants	In progress 2019 plan	Medium/ BMA projects moving forward.
31. **Work with homeowners associations, QBurke, other partners in the Dish Mill Brook watershed to put in rain gardens to reduce stormwater runoff.**	**CCNRCD/** VTDEC**,** Q Burke, Town of Burke, homeowner associations, NVDA	ERP, Private funding, Watershed grant	In progress	Medium/ Several Burke mountain resort rain gardens installed
32. **Work with developers in the Dish Mill Brook watershed to use innovative green stormwater infrastructure techniques in future development proposals.**	**Q Burke/** VTDEC, CCNRCD, NVDA, Developers, VDFPR	Private funding, ERP	In progress 2019 plan	Medium/
33. **Support regulatory review of ski area long term development plans for additional stormwater treatment to handle existing discharges in areas proposed for future development. Evaluate trails network(s) for soil erosion potential. As necessary update Water Quality Remediation Plan.**	**QBurke**, VANR, NRB	QBurke	In progress	Medium/ Grant has funded restoration of Fire road including regrading and pulling culverts on state land along with similar efforts on Burke Mountain Resort property
Objective 8: Reduce phosphorus and sediment loading to stressed lakes, ponds and streams in the Basin. *Related stressors: Channel Erosion, Encroachment, Land Erosion, Nutrient Loading (non-erosion)* **Priority Areas: Maidstone Lake, and Wallace, Stevens, Miles, Mile, West Mountain Ponds- Leach Stream, First and Murphy Brooks (See Figure 5) along with Connecticut River above Moore Reservoir and the Passumpsic River watershed.**				
34. **Work with the communities of Burke, Newark, Danville, Walden, St. Johnsbury and Concord to complete capital improvement inventories and develop a local template that can be applied to other**	**NRCD**/ NVDA, VAOT, VTDEC, Town Road Foreman and Select Boards	Better Backroads grant, Watershed	Completed 2019 plan	Top 10/ All plans completed. Work continuing with communities to develop new plans to meet new MRGP requirements.

Action	Lead/Key Players	Funding	Status	Priority/Update
towns in the basin and that includes use of bridge and culvert assessment data.		Grant, MEF, ERP		
35. **Complete a dirt road erosion inventory (including class IV roads) in the upper Passumpsic River watershed (towns of Wheelock, Sutton, Newark, Burke) to identify priority erosion projects for Better Backroads project grants. Continue work in Kirby, Lyndon, St. Johnsbury, Danville, Walden, Concord, Lunenburg.**	**NVDA**/ NRCD, VAOT, VTDEC, Town Road foreman and select boards	ERP, Better Backroads grant, Watershed grant	In progress 2019 plan	High/ project proposal by NVDA to work with one or two towns in 2018 on class 4 assessments. Town not yet selected.
36. **Complete projects to address major identified sediment sources (or AOP barriers) while working to minimize concentration of runoff into ditches.**	**Towns/**VTDEC, NRCD, VAOT , NVDA,	Better backroads, ERP	In progress 2019 plan	Medium/ Many projects completed…
37. **Purchase a hydroseeder through a cooperative agreement to share with multiple towns.**	**NVDA**/ NRCD, VAOT, VTDEC, Town Road Foreman and Select Boards	MEF, ERP grant	Completed 2019 plan	Medium/ Danville has a shared hydro seeder program with other towns – need to replicate project for other towns.
38. **Set up a series of workshops and trainings with towns to discuss key barriers preventing towns from addressing priority water quality issues associated with transportation infrastructure building on the well attended road resiliency workshop held in 2012.**	**NRCD**/NVDA, VAOT, VTDEC, Town Road Foreman	ERP grant, Watershed grant	Completed	Medium/ CCNRCD received watershed grant to hold workshop in 2014
Objective 9: Restore littoral habitat on impacted lakes and ponds in the Basin. ***Related stressors: Encroachment, Land Erosion, Nutrient Loading (non-erosion)*** **Priority Areas: Shadow, Neils, Coles, and Newark Ponds with reduced habitat from development and Miles, Maidstone, and Joes Ponds with poor shoreline habitat from development (see Figure 5.)**				
39. **Identify lake associations or blocks of interested landowners for targeted outreach for the LakeWise certification program.**	**VTDEC/** Lake associations, NRCD	Watershed grant	Not Started 2019 plan	High/ None in Passumpsic River Basin yet…
40. **Fund buffer restoration to allow landowners to meet LakeWise standards targeted to contiguous blocks of landowners.**	**VTDEC/** Lake associations, NRCD	ERP	In progress 2019 plan	Medium/ pond project going in in 2018 with work crew support.
Objective 10: Monitor and minimize spread of Didymo – and prevent spread of other invasive species not in the basin including Eurasian water milfoil. -- *Related Stressor: Aquatic Invasive Species*				

Action	Lead/Key Players	Funding	Status	Priority/Update
Priority Areas: Basin wide				
41. **Support Upper Connecticut Cooperative Invasive Species Management Area (UCCISMA) as an organization that can coordinate early detection and rapid response for invasive species in this basin.**	**ECNRCD**/ NRCS, VDFPR, VTDEC, Conte, NWSC	MEF	In progress	Medium
42. **Support lake associations in starting up and continuing VIP programs on lakes in the basin.**	**Lake associations**/ VTDEC	ANS	In progress	Medium
Objective 11: Reduce levels of oil and contaminants reaching the Sleepers River. *Related Stressor: Toxic Substances* **Priority Areas: Fairbanks Morse and St. Johnsbury landfill site (see Figure 5.)**				
43. **Continue recovery efforts for oil on the Fairbanks Morse site until threat to surface waters has been sufficiently addressed.**	**Landowners**/ Consultants, VTDEC		In progress	Medium
44. **Complete a Phase 2 brownfield assessment to identify any additional contamination at the Fairbanks Morse site and address any that may be impacting surface waters.**	**St. Johnsbury, NVDA/** VTDEC	Brownfields grant	Not Started 2019 plan	Medium
45. **Consider streambank and floodplain restoration opportunities that might be possible with any redevelopment of the Fairbanks Morse site.**	**St. Johnsbury, Landowners/** NVDA, VTDEC, CCNRCD	ERP, MEF	Not Started 2019 plan	Medium

Appendix C. Municipal Protectiveness Matrix for Basin 15

Table 17. Municipal protectiveness matrix for towns with significant area in Basin 15 (5/22/19)

	National Flood Insurance Program (NFIP)	Road and Bridge Standards	Emergency Operations Plan (LEOP)	Hazard Mitigation Plan (LHMP)	River Corridor Protection	ERAF	Stormwater Master Plan	Illicit Discharge Detection and Elimination	Stormwater Mapping
	Enrolled?	Adopted?	Completed?	Adopted?	Adopted?	Percent	Completed?	Completed?	Completed?
Barnet	Yes	No	No	No	No	7.5%	NA	Yes	NA
Burke	Yes	Yes	No	No	Yes	7.5%	Yes	Yes	Yes
Concord	Yes	Yes	No	Yes	No	7.5%	Yes	Yes	Yes
Danville	Yes	No	No	No	No	7.5%	No	Yes	Yes
East Haven	No	Yes	No	No	No	7.5%	NA	NA	NA
Granby	Yes	Yes	No	Yes	Interim	7.5%	NA	NA	NA
Kirby	Yes	Yes	Yes	Yes	Interim	17.5%	NA	NA	NA
Lyndon	Yes	Yes	No	Yes	Yes	7.5%	Yes	Yes	Yes
Lyndonville Village	Yes	Yes	No	Yes	Yes	7.5%	Yes	Yes	Yes
Newark	No	No	No	No	No	7.5%	NA	NA	NA
Sheffield	No	Yes	No	No	No	7.5%	NA	No	Yes
St. Johnsbury	Yes	Yes	No	Yes	No	7.5%	Yes	Yes	Yes
Stannard	Yes	No	No	No	No	7.5%	NA	NA	NA
Sutton	Yes	Yes	No	No	No	7.5%	NA	NA	NA
Victory	No	Yes	No	No	No	7.5%	NA	NA	NA
Walden	No	Yes	Yes	Yes	No	7.5%	NA	NA	NA
Waterford	Yes	Yes	No	Yes	No	7.5%	NA	NA	NA
Westmore	No	Yes	No	No	No	7.5%	NA	NA	NA
Wheelock	No	Yes	No	No	No	7.5%	NA	No	Yes